

双面影印

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## SURFACE ACOUSTIC WAVE DEVICE

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

5 The present invention relates to a surface acoustic wave device, and in particular to a surface acoustic wave device in which any one of an input and output has balanced or differential terminal pair.

#### 2. Description of the Related Arts

10 The surface acoustic wave device is widely used as a filter in a high frequency circuit of a radio apparatus represented by a portable telephone or the like. In recent years, in the high frequency circuit of this radio apparatus, an integrated circuit element (IC) having a balanced or 15 differential input and output has been used.

On the contrary, a filter using a conventional surface acoustic wave device (hereinafter appropriately referred to as a surface acoustic wave filter) is unbalanced in an I/O terminal. For this reason, for example, as shown in Fig. 1, in the case 20 of connecting with a mixer circuit IC 3, an unbalanced-balanced transforming part which is called a balun, or a transformation circuit 2 constituted by separate parts is necessary between a surface acoustic wave filter 1 and the mixer circuit IC 3.

Furthermore, the surface acoustic wave filter normally 25 has an I/O impedance of  $50\Omega$ , and on the other hand, in many cases, an impedance of the mixer circuit IC 3, etc. having a balanced terminal pair is high up to about 100 to  $200\Omega$ , and an impedance transformation circuit was required for connecting

such the IC with the surface acoustic wave filter.

However, this leads to an increase in the number of using circuit parts in the radio apparatus. Furthermore, for a demand for more downsizing, a design for space-saving is demanded.

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#### SUMMARY OF THE INVENTION

It is therefore an object of the present invention to realize a small-sized surface acoustic wave device having an unbalanced-balanced transformation function and a function of impedance transformation.

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In order to achieve the above object, according to a first aspect of the present invention there is provided a surface acoustic wave device, comprising an input interdigital transducer and an output interdigital transducer, disposed on a surface acoustic wave propagation path of a piezoelectric substrate, wherein when an aperture length of an electrode finger of the input or output interdigital transducer is denoted by  $x$ , the output or input interdigital transducer has two divided interdigital transducers having the electrode finger in which each aperture length is denoted by substantially  $x/2$ , 15 and wherein the two divided interdigital transducers are serial-connected, and the electrodes of the respective electrode fingers are led from the two divided interdigital transducers, and are disposed so that two output and input signals connected to a balance terminal pair have a different phase at  $180^\circ$ .

20

In order to achieve the above object, according to a second aspect of the present invention there is provided a surface acoustic wave device, comprising a plurality of

25

interdigital transducers disposed on a surface acoustic wave propagation path of a piezoelectric substrate, and a reflection electrode disposed at both the sides, wherein the plurality of interdigital transducers contain a first type of interdigital transducer and a second type of interdigital transducer disposed alternately, wherein when an aperture length of an electrode finger of the first type of interdigital transducer is denoted by  $X$ , each of the second type of interdigital transducers has two divided interdigital transducers having an electrode finger in which each aperture length is denoted by substantially  $X/2$ , and wherein the first type of interdigital transducer is connected to an unbalanced input or output terminal pair, and the two divided interdigital transducers are serial-connected, and the electrodes of the respective electrode fingers are led from the two divided interdigital transducers, and are connected to a balanced terminal pair, and the respective electrode fingers of the two divided interdigital transducers are disposed so that phases of signals in the balanced terminal pairs are different at  $180^\circ$ .

Preferably, in the first or second aspect of the present invention, a position of the electrode finger at a side of connecting with the balanced terminal is mutually slid in half-waves, in the two divided interdigital transducers.

Preferably, in the second aspect of the present invention, the plurality of interdigital transducers constitutes a double mode filter by three interdigital transducers.

Preferably, in the second aspect of the present invention, the plurality of interdigital transducers are five or more

interdigital transducers, constituting a multi-electrode filter.

a surface acoustic wave device has two or more filters are cascade-connected, of which the outermost filter is 5 constituted by the surface acoustic wave device according to the above first or second aspect of the present invention, and a balanced terminal pair for an input or output.

Preferably, the piezoelectric substrate may be a 40 to 44° rotated Y-X LiTaO<sub>3</sub>, in any of the above aspects of the present 10 invention.

More, preferably, the piezoelectric substrate may be a 66 to 74° rotated Y-X LiNbO<sub>3</sub>, in any of the above aspects of the present invention.

Features of the present invention will become more clear 15 by the following description with reference to the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view for explaining the case where a conventional surface acoustic wave device is connected to an 20 IC circuit having a balanced input;

Fig. 2 is a view for explaining the case where a surface acoustic wave device as an object of the present invention is connected to the IC circuit having the balanced input;

Fig. 3 is a view showing the surface acoustic wave device 25 according to a first embodiment of the present invention;

Fig. 4 is a view for explaining operation according to the embodiment of Fig. 3;

Fig. 5 is a view showing the surface acoustic wave device

according to a second embodiment of the present invention;

Fig. 6 is a view showing the surface acoustic wave device according to a third embodiment of the present invention;

5 Fig. 7 is a view showing the surface acoustic wave device according to a fourth embodiment of the present invention;

Fig. 8 is a view showing the surface acoustic wave device according to a fifth embodiment of the present invention;

Fig. 9 is a view showing the surface acoustic wave device according to a sixth embodiment of the present invention;

10 Fig. 10 is a view showing the surface acoustic wave device according to a seventh embodiment of the present invention;

Fig. 11 is a view showing the surface acoustic wave device according to an eighth embodiment of the present invention; and

15 Fig. 12 is a view showing the surface acoustic wave device according to a ninth embodiment of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, embodiments of the present invention will be explained with reference to the drawings. Incidentally, the description of the below embodiments are made for understanding 20 of the present invention, and a scope of a protection of the present invention is not limited to the embodiments, the drawings, and the description thereof.

Fig. 2 is a view showing an adaptive example of, a surface acoustic wave device 10 according to the present invention as 25 a surface acoustic wave filter, which is lead to a mixer circuit IC 3 similarly to Fig. 1.

The surface acoustic wave filter according to the present invention has an unbalanced-balanced transformation function

and an impedance transformation function. Thus, it is possible to set a balanced input of the mixer circuit IC 3 to an input impedance. Accordingly, it is possible not to use the independent unbalanced-balanced transformation function and 5 impedance transformation function circuit, which is necessary in Fig. 1. Thus, it is possible to realize a downsizing of the device.

Fig. 3 shows an electrode structure of the surface acoustic wave device 10 according to a first embodiment of the 10 present invention, for use in one example in Fig. 2.

In Fig. 3, a single input interdigital transducer (IDT) 100 and output interdigital transducer (IDT) 200 are disposed on a propagation path of surface acoustic waves formed on a piezoelectric substrate to be described later in detail.

15 A first interdigital electrode finger 101 at one side of the input IDT 100 is connected to an input signal terminal IN, and a counter second interdigital electrode finger 102 is grounded. A width  $X$  overlapped by the first electrode finger 101 and second electrode finger 102 is an aperture length of 20 the input IDT 100.

On the other hand, the output IDT 200 has first and second interdigital or crossover interdigital transducers (IDT) 201, 202 having aperture lengths  $X_1$ ,  $X_2$  substantially half the aperture length  $X$  within a range of the aperture length  $X$  of 25 the input IDT 100.

One electrode finger of the first crossover IDT 201 and one electrode finger of the second crossover IDT 202 are connected to balanced output terminal pairs OUT1, OUT2,

respectively, and further the other electrode fingers of the first and second crossover IDTs 201, 202 are configured so as to be commonly connected, respectively.

5 Here, in particular, the electrode fingers of the first and second IDTs 201, 202 are configured so that the positions are mutually slid by 1 cycle in a position of the electrode finger, namely by 1/2 of a surface acoustic wavelength.

10 Fig. 4 is a view for explaining an operational principle in an electrode structure of Fig. 3, and in particular, typically showing a behavior when the surface acoustic waves (hereinafter SAW) propagate between an input and output. Here, an upside of the two divided output IDTs 201, 202 is called a track 1, and a downside thereof is called a track 2.

15 A certain moment when the surface acoustic wave device is operating is considered. First, an input electric signal is transformed to the SAW by the input IDT 100. This SAW is propagated on the piezoelectric substrate. Furthermore, the SAW is incident on each of the first and second crossover IDTs 201, 202 of the output IDT 200 as the track 1 and track 2. In 20 Fig. 4, each SAW amplitude of the tracks 1, 2 is shown.

When the SAW is incident on the tracks 1, 2, the SAW is transformed again into an electric signal. At this time, the position of the electrode finger is slid at half wavelength between the tracks 1 and 2. For this reason, phases of the 25 electric signal obtained by output terminal pairs OUT1, OUT2 are mutually slid at  $180^\circ$ , to which acceptable  $\pm 10^\circ \sim 15^\circ$  deviations may occur.

That is, in the embodiment of Fig. 3, it is apprehensible

that a balanced terminal pair is formed between the output terminal pairs OUT1 and OUT2, thereby realizing an unbalanced input-balanced output. Next, an I/O impedance will be considered. A capacitance impedance is formed between the 5 electrode fingers of the IDT, and a magnitude of the capacitance impedance is determined according to an interval of the electrode fingers and aperture length.

In Fig. 4, an interval A-B between the electrode fingers of input IDT 100 is equal to an interval C-D of the electrode 10 fingers of the output IDT 200. Accordingly, when the input impedance is  $50\Omega$ , since in the impedance of the IDT 201 at a track 1 side, an aperture length  $X_1$  of the IDT 201 is about half the aperture length  $X$  of the input IDT 100, the impedance becomes doubled, or about  $100\Omega$ .

15 On the other hand, the impedance of the IDT 202 at the track 2 side similarly becomes about  $100\Omega$ . Accordingly, when viewed between the balanced terminal pairs OUT1 and OUT2, since the two output IDTs 201, 202 are serial-connected, the entire 20 impedance at the output side becomes about  $200\Omega$ . Thus, it becomes possible to transform the I/O impedance from  $50\Omega$  to  $200\Omega$ .

Fig. 5 is a view showing a second embodiment of the present invention. Fig. 5 shows an electrode finger configuration of the IDT formed on the piezoelectric substrate similarly with 25 Fig. 3. The two input IDTs 101, 102 and the one output IDT 200 so as to be pinched therebetween are disposed. Furthermore, both the sides comprise reflectors 301, 302, forming a so-called double mode filter configuration.

Here, according to the present invention, when the output IDT 200 is divided into the upper and lower two IDTs 201, 202 in the same manner as in the example of Fig. 3, the two signals fetched out therefrom are balance-output between the output 5 terminal pairs OUT1 and OUT2.

In the case where such the double mode filter is used, it is possible to realize an unbalanced-balanced filter of high attenuation.

Furthermore, in the embodiment of Fig. 5 also, the 10 impedance transformation function is same with that described previously in Fig. 4.

Fig. 6 shows a third embodiment of the present invention, and shows the electrode finger configuration of the IDT formed on the piezoelectric substrate in the same manner as in the 15 preceding example. This embodiment also has a double mode filter configuration. It is characterized in that two combinations (IDTs 201, 202, and IDTs 203, 204) of the IDTs are used at an output side in opposition to the embodiment of Fig. 5.

The same characteristic as in the second embodiment can 20 be obtained, and it is valid in the case where the output impedance is desired to set lower than the second embodiment. That is, as described above, the two combinations (IDTs 201, 202, and IDTs 203, 204) of the IDTs are used, and these are 25 parallel-connected to the balanced output terminal pairs OUT1, OUT2.

Accordingly, when the I/O impedance of the input IDT 100 is  $50\Omega$ , in the embodiment of Fig. 6, the output impedance becomes

100Ω.

Fig. 7 shows a fourth embodiment of the present invention, and has a multi-electrode type surface acoustic wave filter comprising 5 IDTs, of which the three input IDTs 101 to 103 and 5 two sets of the output IDTs 201 to 202, and 203 to 204 are alternately disposed.

In general, the multi-electrode type can be defined as containing a plurality of (three or more) IDTs. The embodiment of the double mode type of Fig. 6 corresponds to the case of 10 containing a minimum piece of IDTs in the multi-electrode type.

Here, in this configuration, each output of the two sets of the output IDTs 201 to 202, and 203 to 204 is led to the balanced output terminal pairs OUT1, OUT2. In the configuration of this embodiment, it is possible to realize a 15 balanced filter of a relatively wide passband width.

Fig. 8 further shows a fifth embodiment of the present invention, and shows a configuration of the electrode finger of the IDT formed on the piezoelectric substrate in the same manner as in the preceding examples.

The fifth embodiment is same as in the embodiment of Fig. 20 7 in that the multi-electrode configuration is used, but the 7 three sets of the IDTs 201 to 202, 203 to 204, and 205 to 206 is used at the output side. The same characteristic as in Fig. 7 can be obtained, and it is valid in the case where the output 25 impedance is desired to set lower than the embodiment of Fig. 7.

Fig. 9 shows a sixth embodiment of the present invention, and shows a configuration of the electrode finger of the IDT

formed on the piezoelectric substrate in the same manner as in the preceding example. The multi-electrode type filter is configured by two-stage cascade-connection. That is, first stage IDTs 103 to 105 are cascade-connected to second stage IDTs 5 113 to 115.

Furthermore, as the output IDT of the filter at the second stage, the two sets of IDTs 201 to 202, and 203 to 204 are used. The output of the two sets of IDTs 201 to 202, and 203 to 204 is fetched out to the balanced output terminal pairs OUT1, OUT2.

When such the configuration is used, since the cascade connection is made at the first stage and second stage, it is advantageous that an attenuation amount can be largely taken.

Fig. 10 shows a seventh embodiment of the present invention, and shows a configuration of the electrode finger of the IDT formed on the piezoelectric substrate in the same manner as in the preceding example. The seventh embodiment has the same configuration as in the embodiment of Fig. 5 in that serial-resonators configured so as to have an IDT 110 and reflecting IDTs 111, 112 at an input side of the double mode filter are cascade-connected.

This embodiment is characterized in that, by setting appropriately frequencies of the serial resonator, the attenuation amount at a side of high frequencies in the vicinity of a passband can be largely taken.

Fig. 11 shows an eighth embodiment of the present invention, and shows a configuration of the electrode finger of the IDT formed on the piezoelectric substrate in the same manner as in the preceding examples. The embodiment of Fig.

11 is extended the embodiment of Fig. 10, and is configured so that the serial resonators configured having an IDT 120 and reflecting IDTs 121, 122 are further parallel-connected, with respect to the serial resonator configured having the IDT 110 5 and the reflecting IDTs 111, 112 which are cascade-connected to a so-called ladder type filter at the input side of the double mode filter.

In this configuration, the attenuation amount in the vicinity of the band can be largely taken without so 10 deteriorating an insertion loss in a passing band, and a balanced filter can be realized.

Fig. 12 shows a ninth embodiment of the present invention, and shows a configuration of the electrode finger of the IDT formed on the piezoelectric substrate in the same manner as in 15 the preceding examples. The double mode filter is cascade-connected. The double mode filter at a first stage is configured by an IDT 113 connected to an input terminal IN, output IDTs 211, 212, and reflecting IDTs 311, 312.

The output IDTs 211, 212 of the double mode filter at a 20 first stage are connected to the input IDTs 101, 102 of the double mode filter at a second stage. This embodiment is configured so that an output IDT 200 of the filter at a second stage is divided into the IDTs 201, 202.

In this embodiment, the insertion loss of the passband 25 is small, and it is possible to realize the balanced filter having high attenuation characteristic.

Here, in the respective embodiments, the description was made that the electrode fingers configuring the IDTs are formed

and disposed on the piezoelectric substrate. As the piezoelectric substrate in which a loss of the surface acoustic waves which can propagate is minimized, and which has a wide band width, these inventors, etc. have proposed previously the piezoelectric substrate in Japanese Patent Application 5 Laid-Open No. 8-179551. Accordingly, it is desirable that the piezoelectric substrate such-proposed previously is also used in the present invention.

10 This preferable piezoelectric substrate is a 40 to 44° rotated Y-X LiTaO<sub>3</sub>, which is cut out from LiTaO<sub>3</sub> single crystal rotated around the X axis at a rotated angle from the Y axis to the Z axis, the rotated angle being in a range between 40° and 44. A 66 to 74° rotated Y-X LiNbO<sub>3</sub> is also preferable, which is cut out from LiNbO<sub>3</sub> single crystal rotated around the X axis 15 at a rotated angle from the Y axis to the Z axis, the rotated angle being in a range between 66° and 74°.

Furthermore, the description was made that the input side is unbalanced and the output side is balanced as how to use the surface acoustic wave device in the respective embodiments, but 20 this is reversible, and it is also possible that the input side of the surface acoustic wave device according to the present invention is balanced, and the output side thereof is unbalanced for adaptation.

As the embodiments were described above with reference 25 to the drawings, according to the present invention, it is possible to realize the surface acoustic wave device having an unbalanced-balanced transformation function, and the impedance transformation function between the unbalanced-

balanced terminals.

Thus, it is possible to provide a small-sized configuration of the communication device, etc. on which the surface acoustic wave device is mounted.

WHAT IS CLAIMED IS:

1. A surface acoustic wave device, comprising an input interdigital transducer and an output interdigital transducer, 5 disposed on a surface acoustic wave propagation path of a piezoelectric substrate, wherein

when an aperture length of an electrode finger of the input or output interdigital transducer is denoted by  $X$ , the output or input interdigital transducer has two divided 10 interdigital transducers each having the electrode finger in which each aperture length is denoted by substantially  $X/2$ , and wherein

the two divided interdigital transducers are serial-connected, and the electrodes of the respective electrode 15 fingers are led from the two divided interdigital transducers, and are disposed so that two output or input signals connected to a balance terminal pair have a different phase at  $180^\circ$ .

2. A surface acoustic wave device, comprising a plurality 20 of interdigital transducers disposed on a surface acoustic wave propagation path of a piezoelectric substrate, and a reflection electrode disposed at both the sides, wherein

the plurality of interdigital transducers contain a first type of interdigital transducer and a second type of 25 interdigital transducer disposed alternately, wherein

when an aperture length of an electrode finger of the first type of interdigital transducer is denoted by  $X$ , each of the second type of interdigital transducers has two divided

interdigital transducers each having an electrode finger in which each aperture length is denoted by substantially  $X/2$ , and wherein

5 the first type of interdigital transducer is connected to an unbalanced input or output terminal pair, and the two divided interdigital transducers are serial-connected, and the electrodes of the respective electrode fingers are led from the two divided interdigital transducers, and are connected to a balanced terminal pair, and the respective electrode fingers 10 of the two divided interdigital transducers are disposed so that phases of signals in the balanced terminal pairs are different at  $180^\circ$ .

3. The surface acoustic wave device according to claim 1, 15 wherein

in the two divided interdigital transducers, a position of the electrode finger at a side of connecting with the balanced terminal is mutually slid in half-waves.

20 4. The surface acoustic wave device according to claim 2, wherein

in the two divided interdigital transducers, a position of the electrode finger at a side of connecting with the balanced terminal is mutually slid in half-waves.

25 5. The surface acoustic wave device according to claim 2, wherein

the plurality of interdigital transducers constitutes a double mode filter by three interdigital transducers.

6. The surface acoustic wave device according to claim 2,  
wherein

5 the plurality of interdigital transducers are five or  
more interdigital transducers, constituting a multi-electrode  
filter.

7. A surface acoustic wave device comprising:

10 two or more filters being cascade-connected, of which the  
outermost filter including,

an input interdigital transducer and an output  
interdigital transducer, disposed on a surface acoustic wave  
propagation path of a piezoelectric substrate, wherein

15 when an aperture length of an electrode finger of the  
input or output interdigital transducer is denoted by  $X$ , the  
output or input interdigital transducer has two divided  
interdigital transducers each having the electrode finger in  
which each aperture length is denoted by substantially  $X/2$ , and  
wherein

20 the two divided interdigital transducers are  
serial-connected, and the electrodes of the respective  
electrode fingers are led from the two divided interdigital  
transducers, and are disposed so that two output or input  
signals connected to a balance terminal pair have a different  
25 phase at  $180^\circ$ ; and

a balanced terminal pair being used as an input or an  
output.

8. A surface acoustic wave device comprising:

two or more filters being cascade-connected, of which the outermost filter including,

5 a plurality of interdigital transducers disposed on a surface acoustic wave propagation path of a piezoelectric substrate, and a reflection electrode disposed at both the sides, wherein

10 the plurality of interdigital transducers contain a first type of interdigital transducer and a second type of interdigital transducer disposed alternately, wherein

15 when an aperture length of an electrode finger of the first type of interdigital transducer is denoted by  $X$ , each of the second type of interdigital transducers has two divided interdigital transducers each having an electrode finger in which each aperture length is denoted by substantially  $X/2$ , and wherein

20 the first type of interdigital transducer is connected to an unbalanced input or output terminal pair, and the two divided interdigital transducers are serial-connected, and the electrodes of the respective electrode fingers are led from the two divided interdigital transducers, and are connected to a balanced terminal pair, and the respective electrode fingers of the two divided interdigital transducers are disposed so that phases of signals in the balanced terminal pairs are different 25 at  $180^\circ$ ; and

a balanced terminal pair being used as an input or an output.

9. A surface acoustic wave device according to any one of

claims 1 to 8, wherein

the piezoelectric substrate is a 40 to 44° rotated Y-X LiTaO<sub>3</sub>.

5 10. A surface acoustic wave device according to any one of claims 1 to 8, wherein

the piezoelectric substrate is a 66 to 74° rotated Y-X LiNbO<sub>3</sub>.

ABSTRACT OF THE DISCLOSURE

A surface acoustic wave device includes an input interdigital transducer and an output interdigital transducer, 5 disposed on a surface acoustic wave propagation path of a piezoelectric substrate, wherein when an aperture length of an electrode finger of the input or output interdigital transducer is denoted by  $x$ , the output or input interdigital transducer has two divided interdigital transducers having the electrode 10 finger in which each aperture length is denoted by substantially  $x/2$ , wherein the two divided interdigital transducers are serial-connected, and the electrodes of the respective electrode fingers are led from the two divided interdigital transducers, and are disposed so that two output and input 15 signals connected to a balance terminal pair have a different phase at  $180^\circ$ .

双面影印

FIG. 1

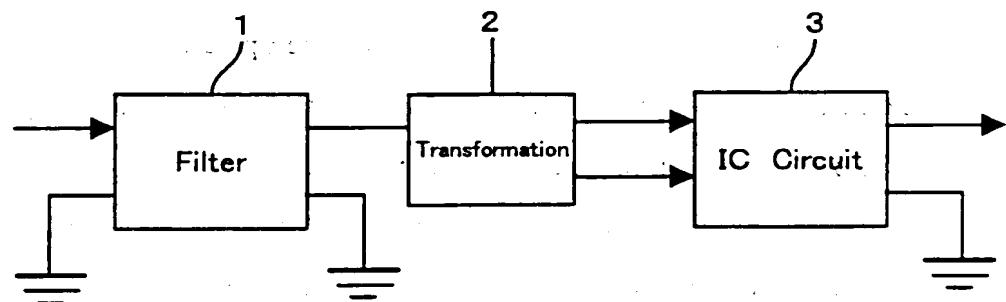


FIG. 2

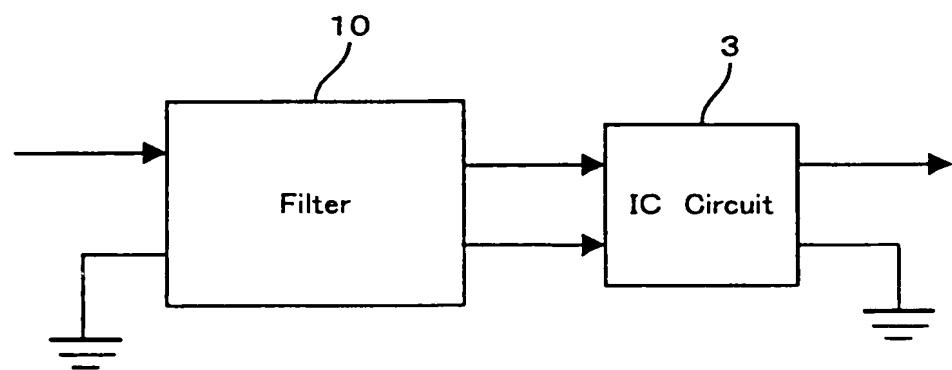


FIG. 3

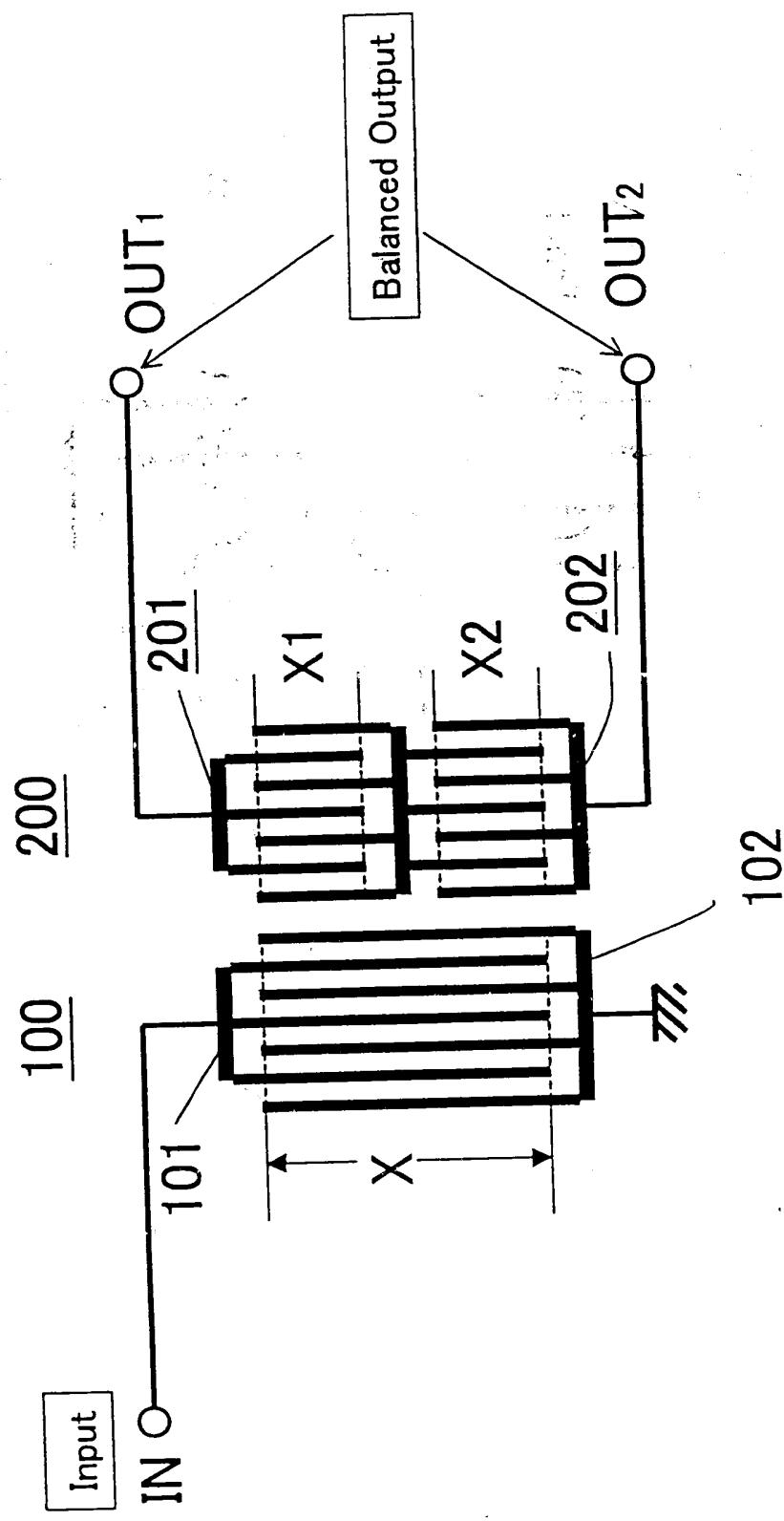


FIG. 4

100

200

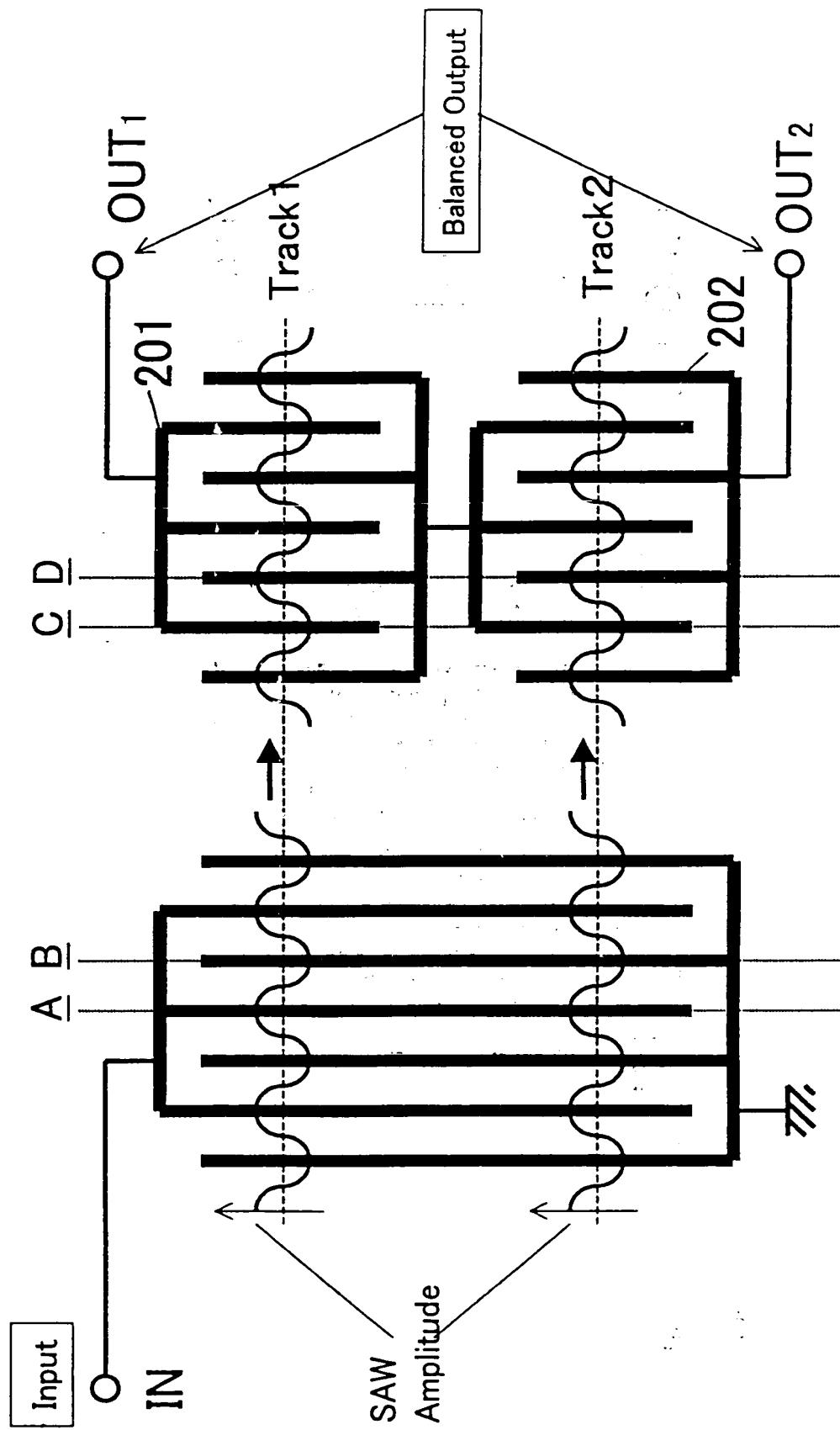


FIG. 5

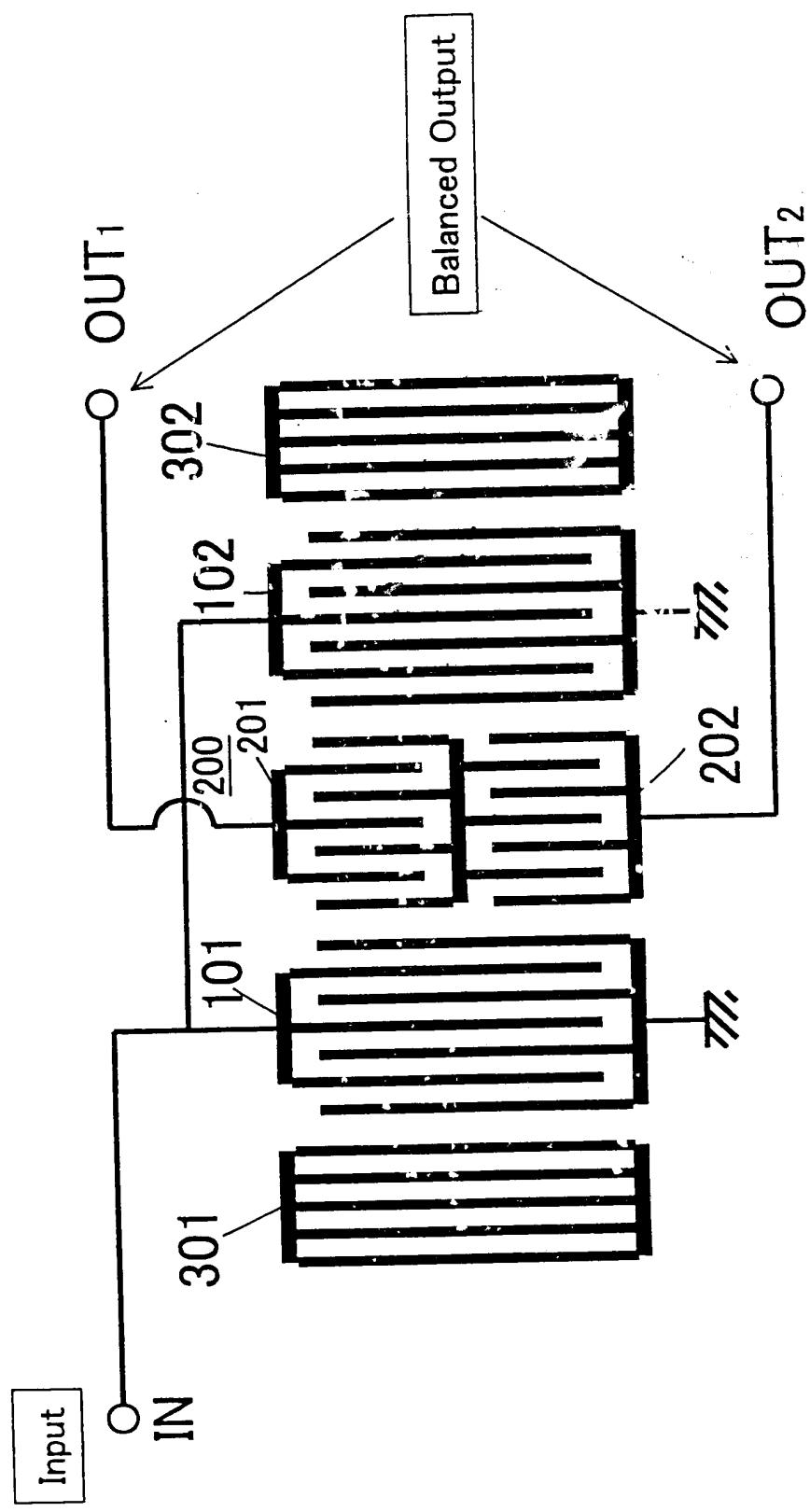


FIG. 6

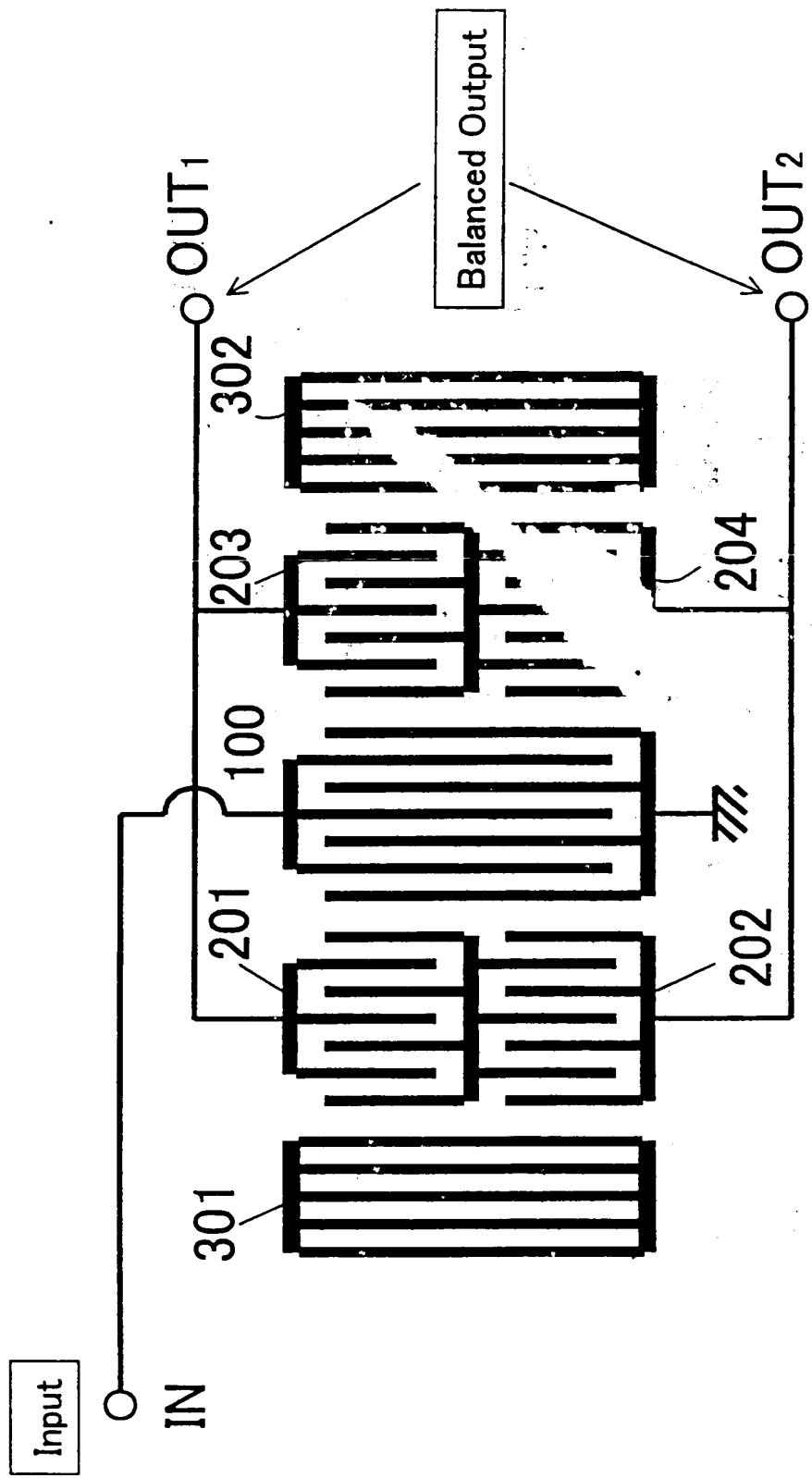


FIG. 7

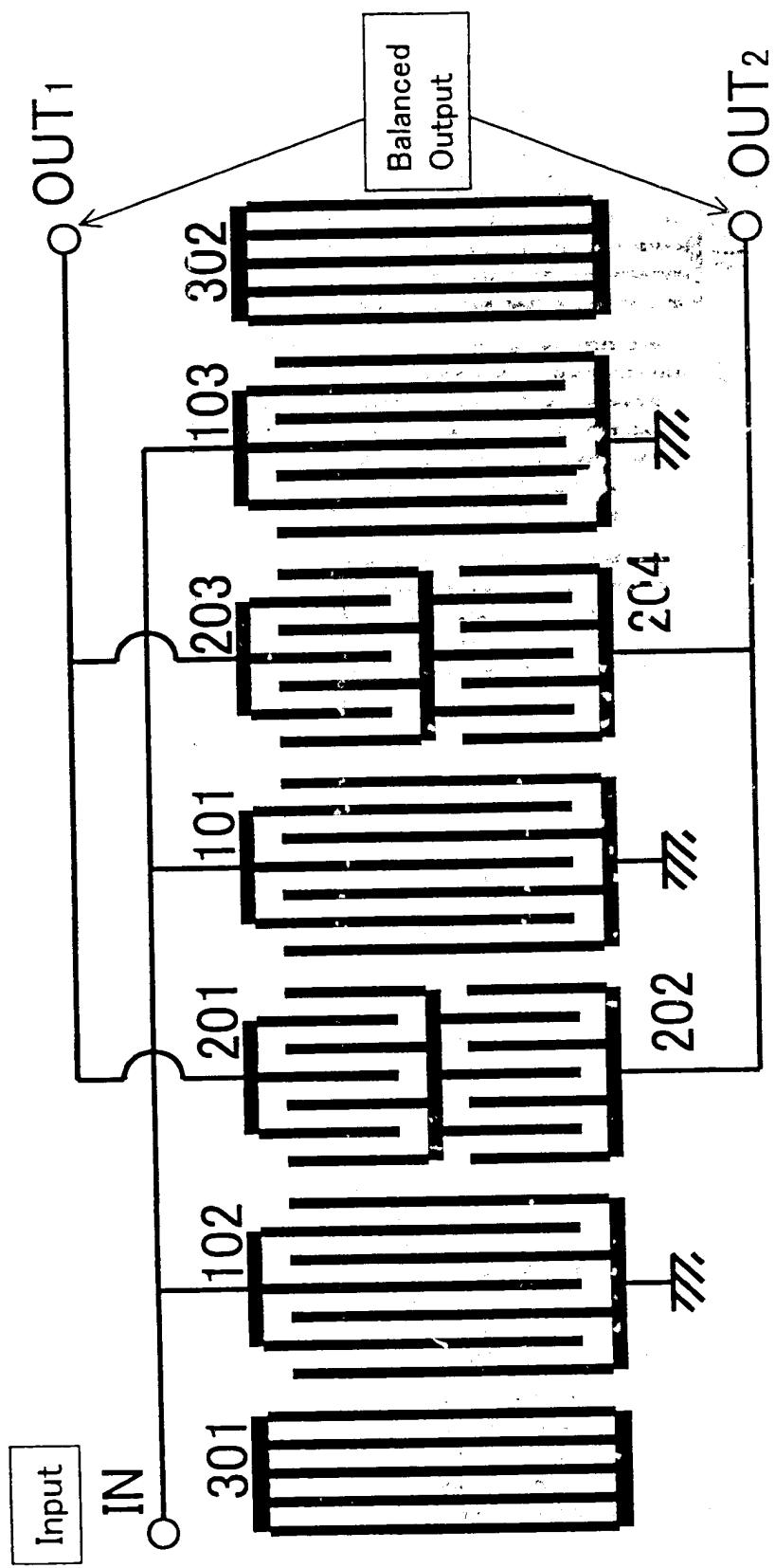


FIG. 8

Input

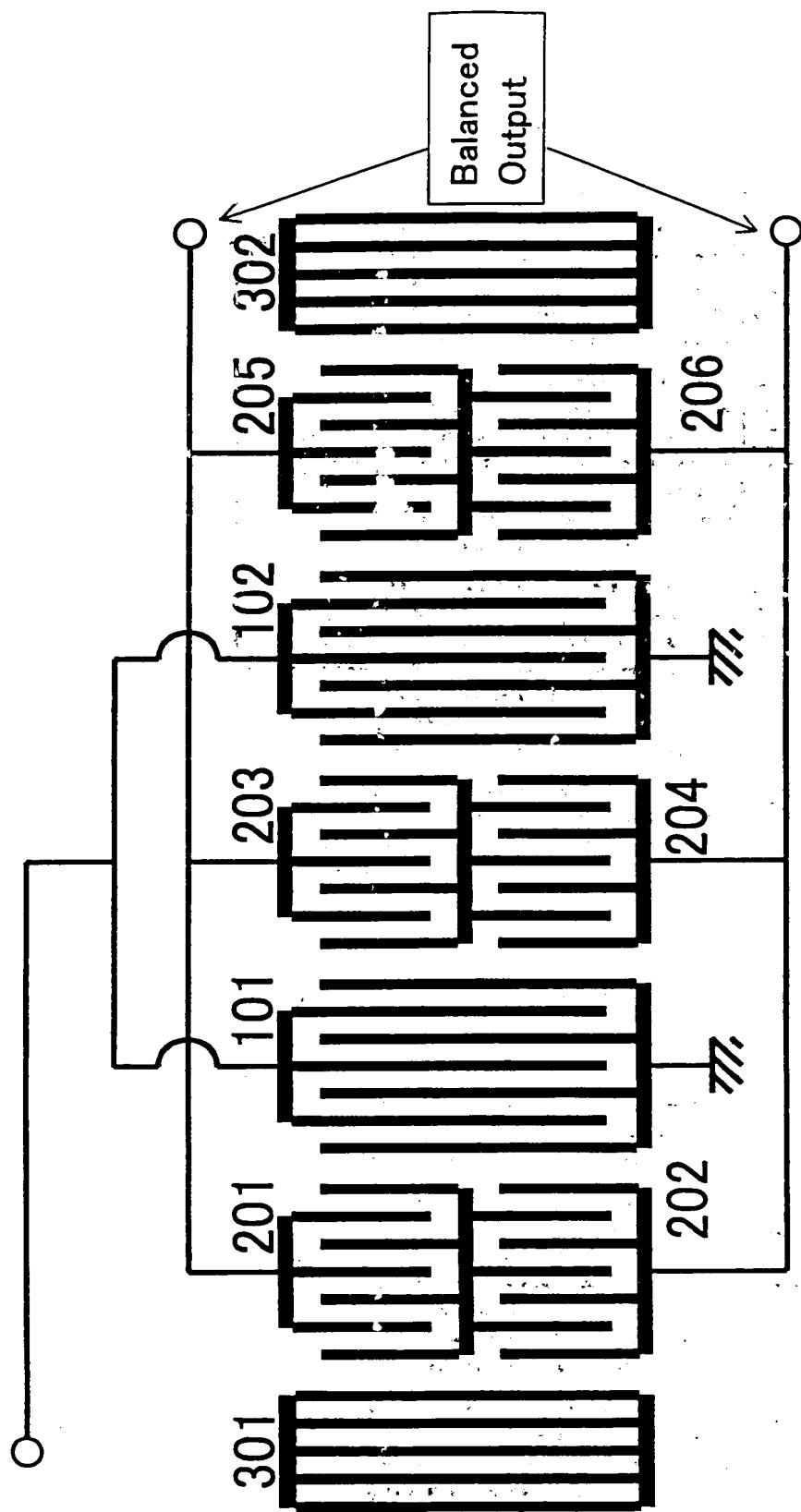


FIG. 6

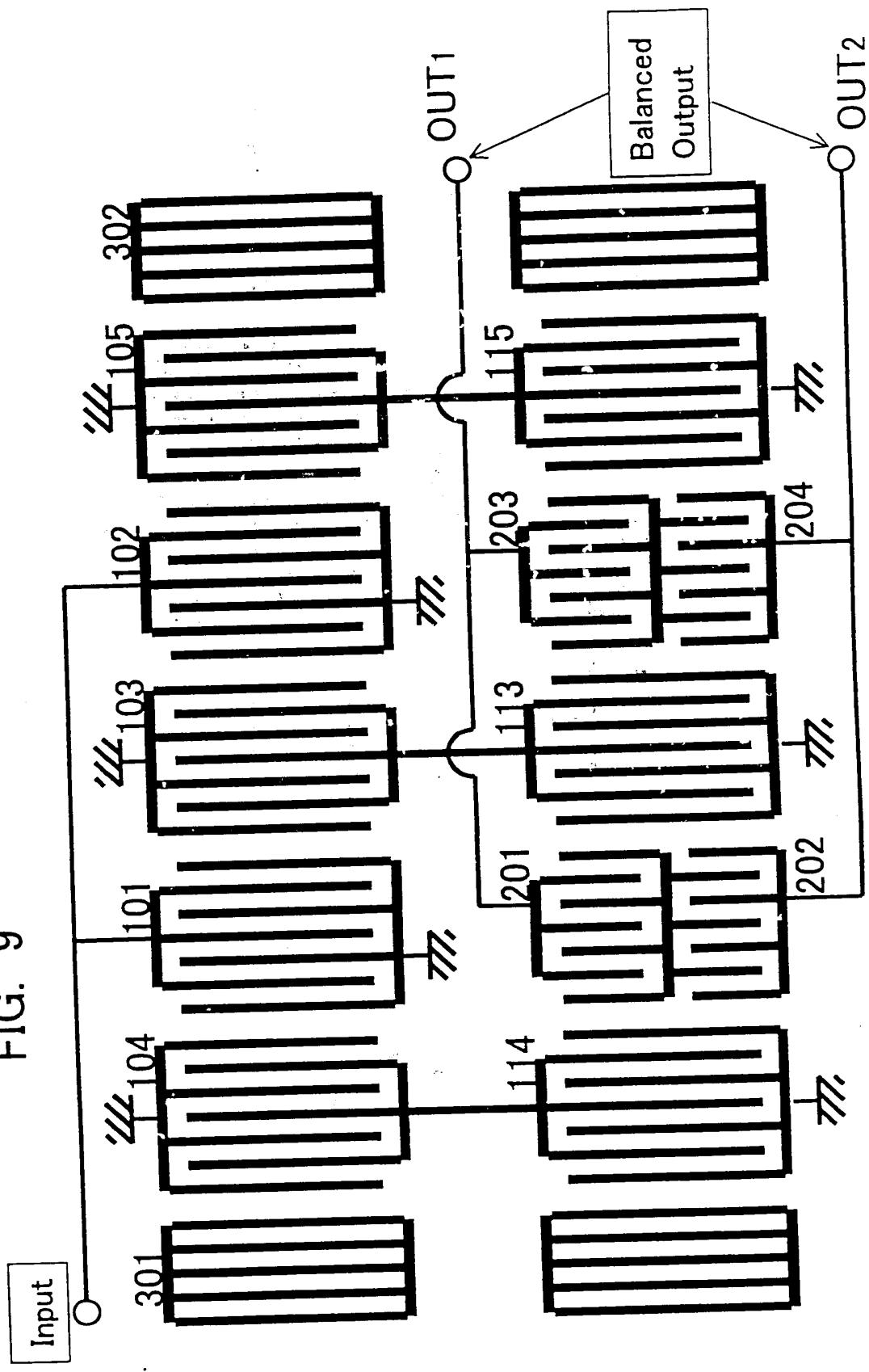


FIG. 10

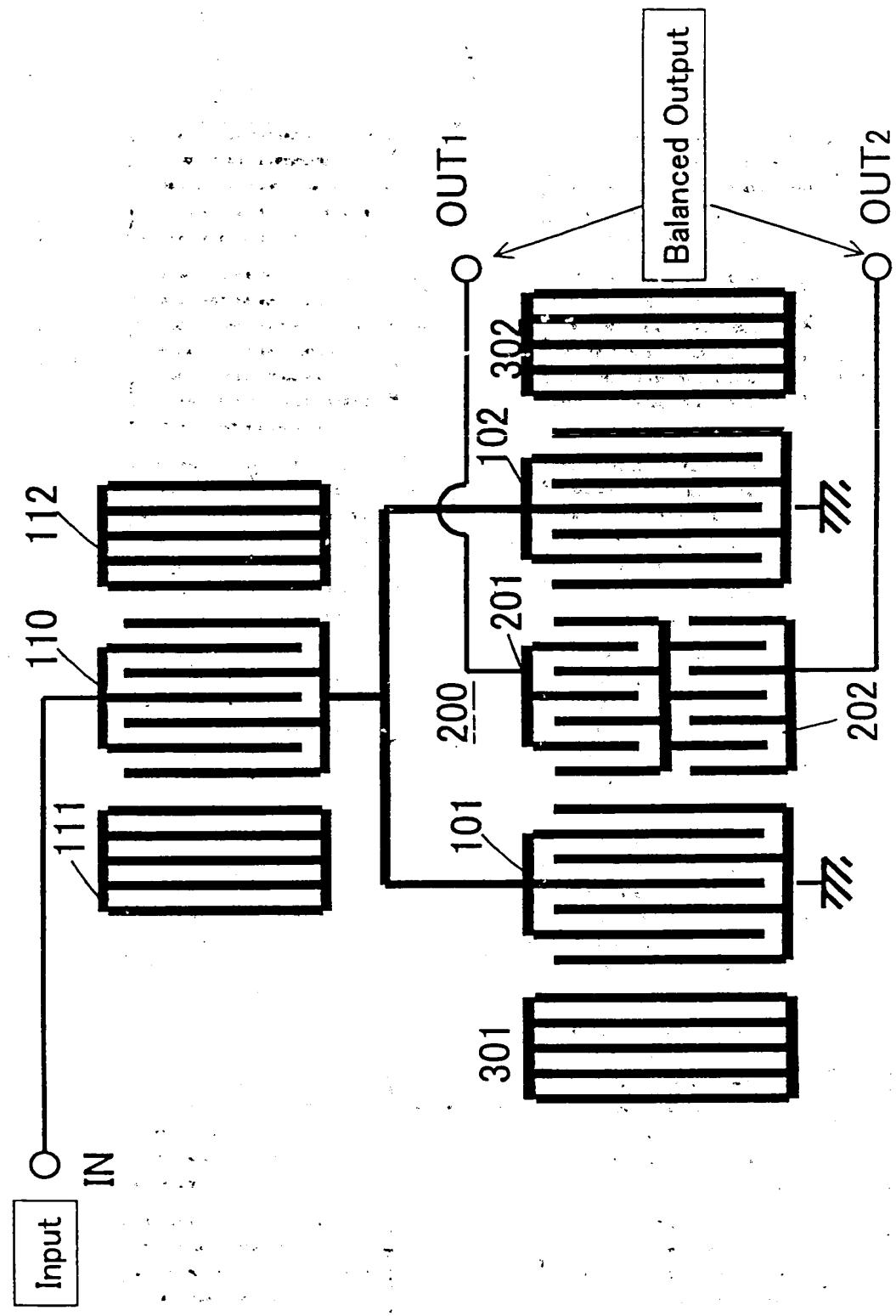


FIG. 11

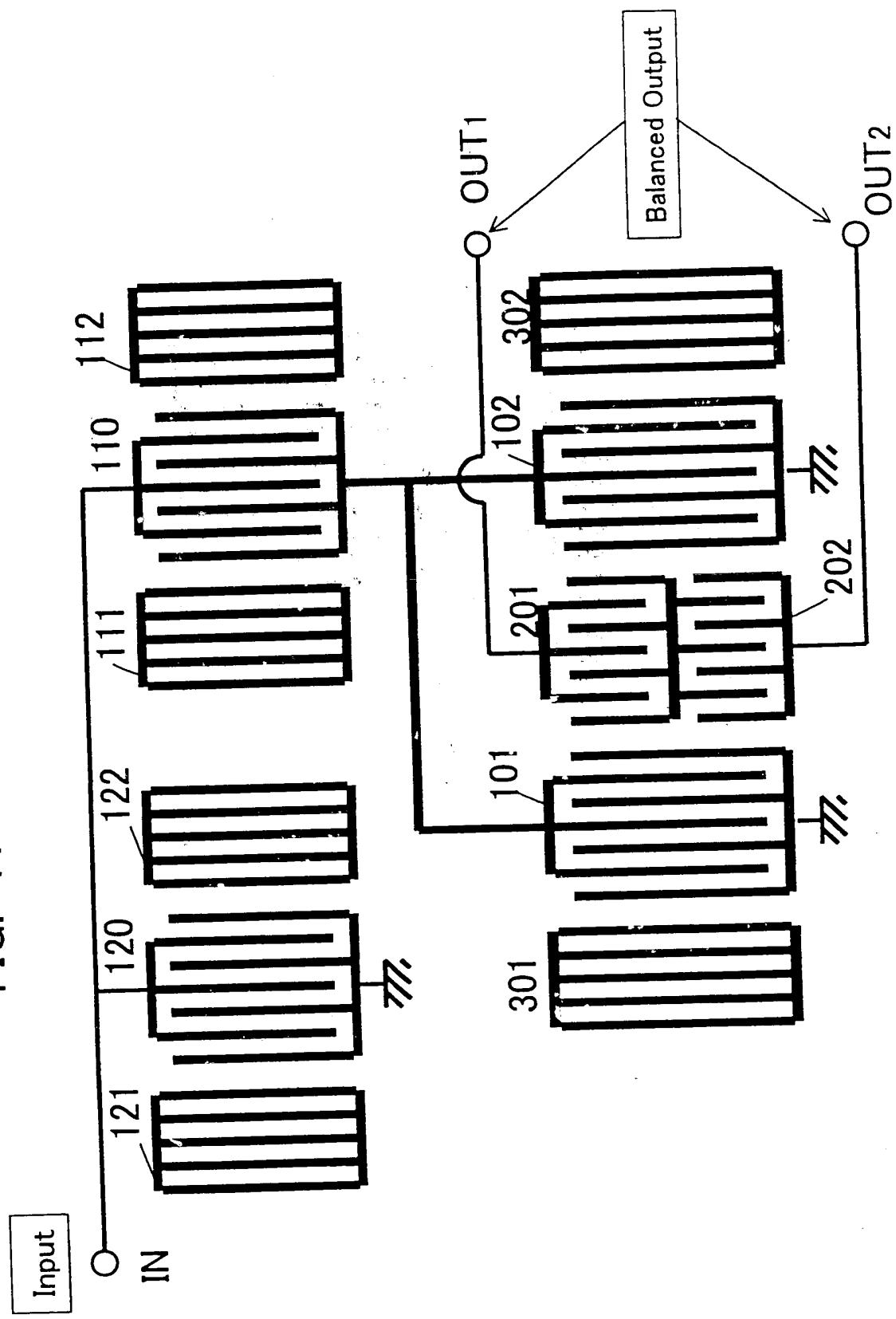
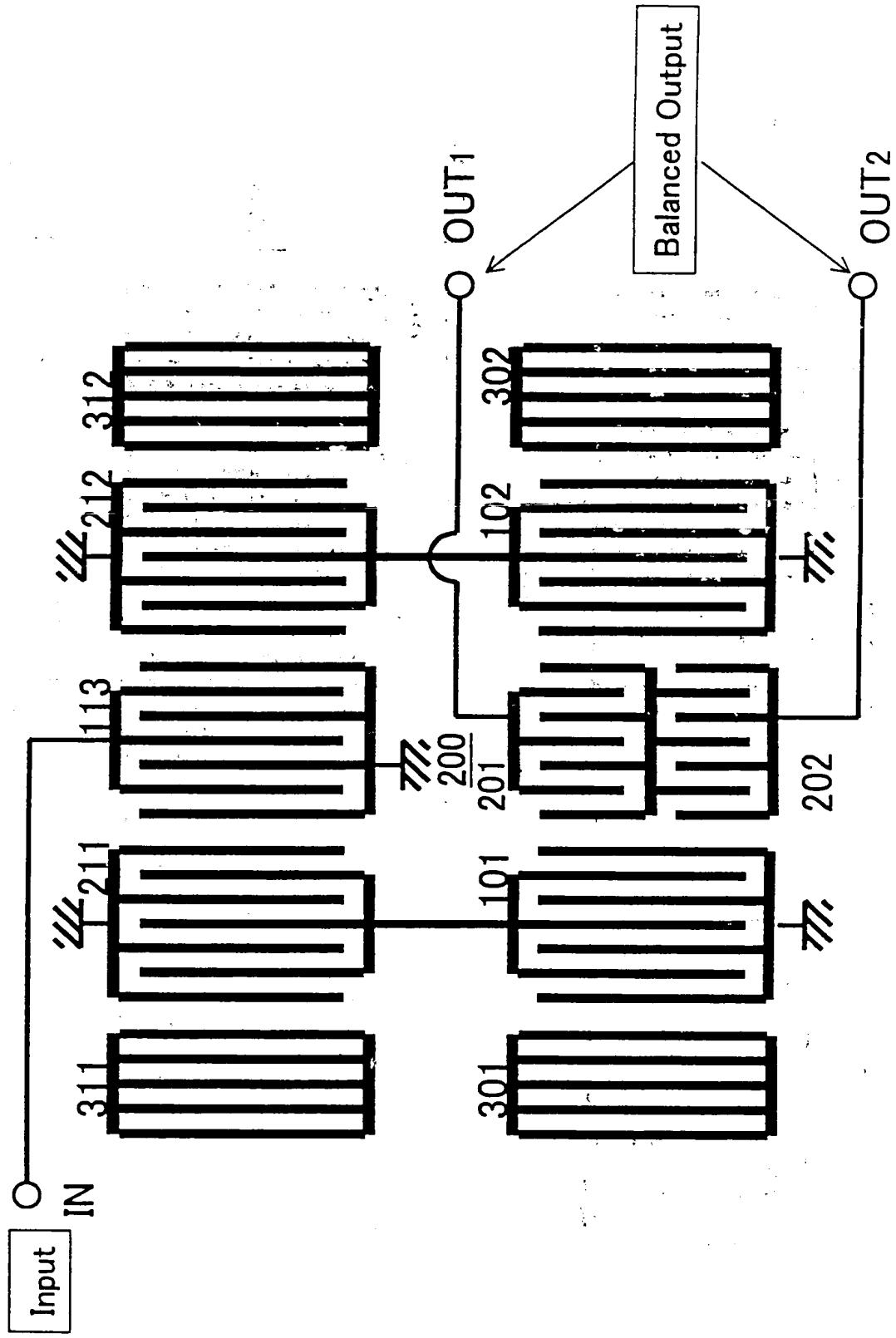
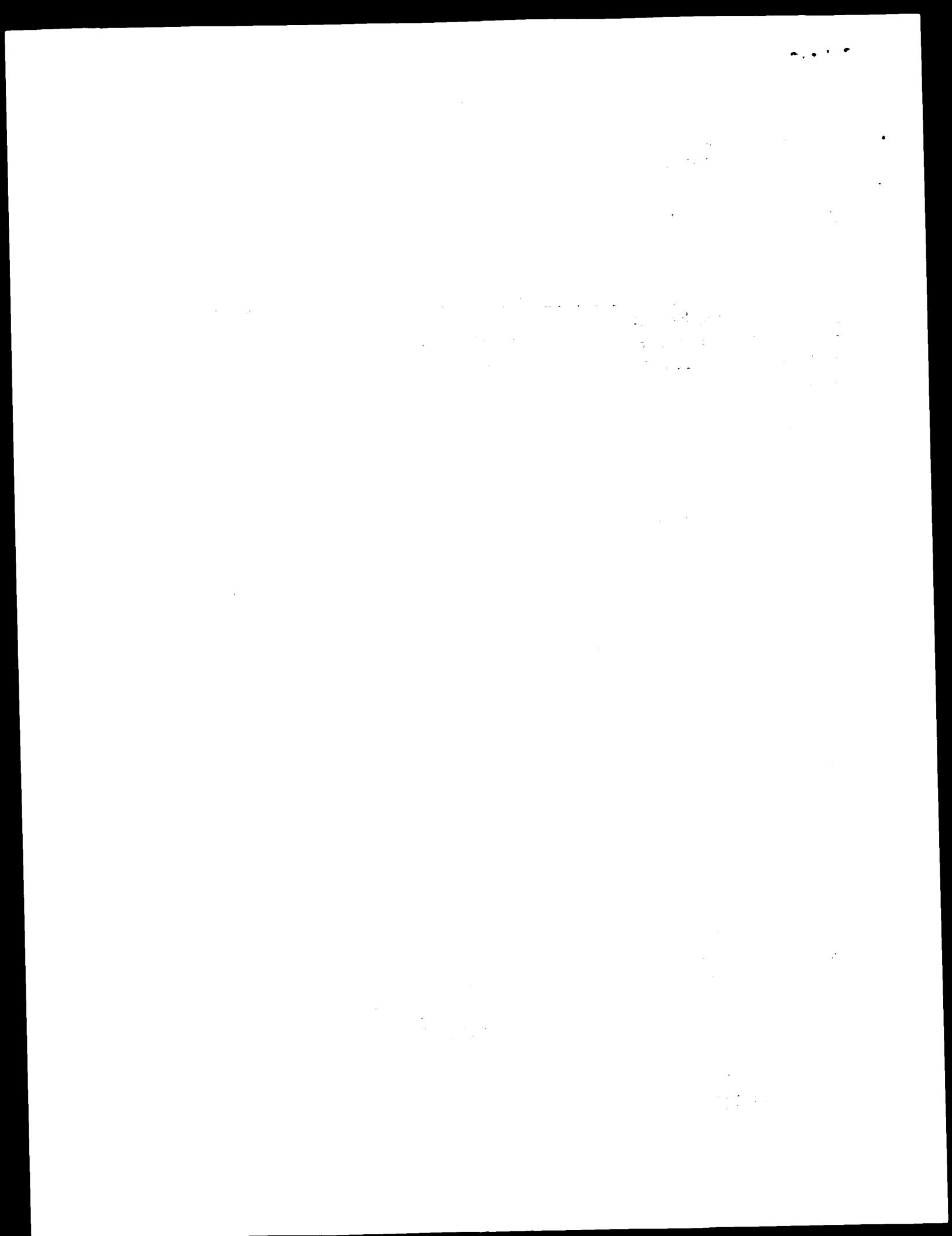


FIG. 12





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[57]申請專利範圍：

1. 一種表面聲波裝置，其包含一輸入指間轉換器與一輸出指間轉換器，該裝置配置在一壓電基體的一表面聲波傳遞路徑上，其中  
當輸入或輸出指間轉換器之一的電極指孔徑長度以  $X$  代表時，該輸入或輸出指間轉換器有二個分開指間轉換器，每個轉換器均有電極指，電極指中的每個孔徑長度實質上以  $X/2$  代表，並且其中，該二個分開指間轉換器是串列連接的，而個別電極指的電極均引導自二個分開指間轉換器且被配置，以使連接到一平衡端子對的二個輸入與輸出信號具有相差  $180^\circ$  的相位。

2. 一種表面聲波裝置，其包含組配在一壓電基體之一表面彎波傳遞路徑上的多個指間轉換器，與一個配置在二邊的反射電極，其中  
多個指間轉換器包含替代配置之第

5.

10.

15.

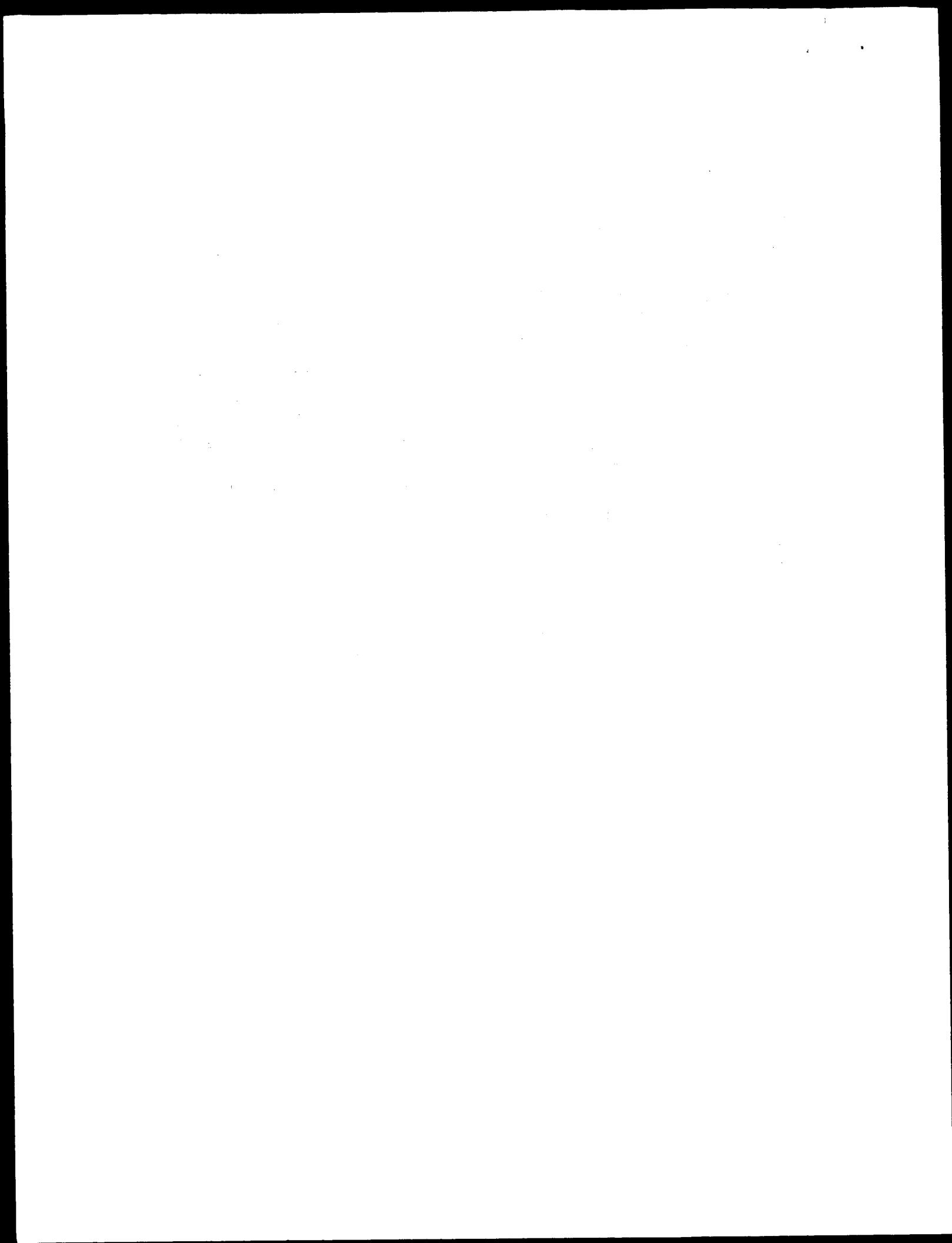
20.

一種指間轉換器與第二種指間轉換器，其中

當第一種指間轉換器之一的電極指孔徑長度以  $X$  代表時，每個第二指間轉換器具有二個分開指間轉換器，每個轉換器均有一電極指，電極指中的每個孔徑長度實質上以  $X/2$  代表，並且其中，

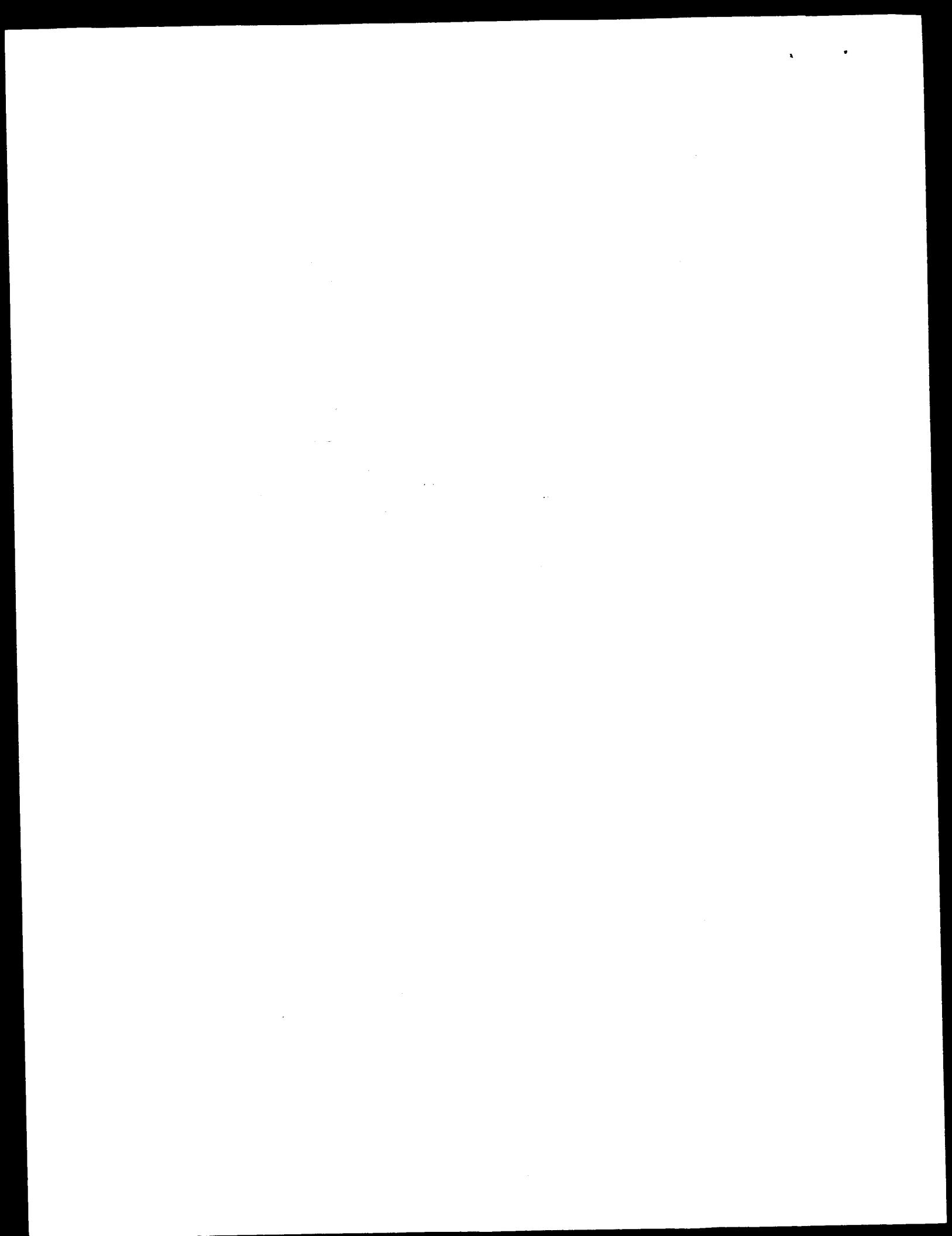
該第一種指間轉換器是連接到一不平衡輸入或輸出端子對，而該二個分開指間轉換器是串列連接的，而個別電極指的電極都是引導自二個分開指間轉換器，並且連接到一平衡端子對，二個分開指間轉換器的個別電性指被配置，以使平衡端子對中之信號相位相差  $180^\circ$  。

3. 如申請專利範圍第 1 項之裝置，其中在該二個分開指間轉換器中，位於連接於該平衡端子邊的電極指位置以半波為單位互相滑移。



- 4.如申請專利範圍第2項之裝置，其中在該二個分開指間轉換器中，位於連接於該平衡端子邊的電極指位置以半波為單位互相滑移。
- 5.如申請專利範圍第2項之裝置，其中多個指間轉換器利用三個指間轉換器，構成一個雙重模式濾波器。
- 6.如申請專利範圍第2項之裝置，其中該多個指間轉換器為五個或更多個指間轉換器，其構成一個多重電極濾波器。
- 7.一種表面聲波裝置，其包含：  
二個或更多個級聯連接的濾波器，其最外面的濾波器包含，  
—輸入指間轉換器與一輸出指間轉換器，其配置在一壓電基體的一表面聲波傳遞路徑上，其中  
當輸入或輸出指間轉換器之一電極指的孔徑長度以 $X$ 代表時，該輸入或輸出指間轉換器有二個分開指間轉換器，每個轉換器均有電極指，電極指中的每個孔徑長度實質上以 $X/2$ 代表，並且其中  
該二個分開指間轉換器是串列連接的，而個別電極指的電極均引導自二個分開指間轉換器且被配置，以使連接到一平衡端子對的二個輸入與輸出信號具有相差 $180^\circ$ 的相位；以及  
被使用作為一輸入端或輸出端的一平衡端子對。
- 8.一種表面聲波裝置，其包含：  
二個或更多個級聯連接的濾波器，其最外面的濾波器包含，  
組配在一壓電基體之一表面聲波傳遞路徑上的多個指間轉換器，與一個配置在二邊的反射電極，其中  
該多個指間轉換器包含交替配置的第一種指間轉換器與第二種指間轉換器，其中

- 5.當第一種指間轉換器之一電極指的孔徑長度以 $X$ 代表時，每個第二指間轉換器具有二個分開指間轉換器，每個轉換器均有一電極指，電極指中的每個孔徑長度實質上以 $X/2$ 代表，並且其中，  
該第一種指間轉換器是連接到一不平衡輸入或輸出端子對，而該二個分開指間轉換器是串列連接的，而個別電極指的電極都是引導自二個分開指間轉換器，並且連接到一平衡端子對，二個分開指間轉換器的個別電極指被配置，以使一平衡端子對中之信號相位相差 $180^\circ$ ；以及被使用作為一輸入端或輸出端的一平衡端子對。
- 10.9.如申請專利範圍第1到第8項之任一項的表面聲波裝置，其中  
該壓電基體可為一旋轉 $40$ 至 $44^\circ$ 的 $Y\text{-}X\text{LiTaO}_3$ 。
- 15.10.如申請專利範圍第1到第8項之任一項的表面聲波裝置，其中  
該壓電基體可為一旋轉 $66$ 至 $74^\circ$ 的 $Y\text{-}X\text{LiNbO}_3$ 。
- 20.25.圖式簡單說明：  
第1圖說明當一傳統表面聲波裝置連接到一具有平衡輸入端的IC電路的情況；  
第2圖說明作為本發明目的之一表面聲波裝置連接到一具有平衡輸入端的IC電路的情況；  
第3圖顯示根據本發明之第一實施例的表面聲波裝置；  
第4圖說明根據第3圖之實施例的操作；  
第5圖顯示根據本發明之第二實施例的表面聲波裝置；  
第6圖顯示根據本發明之第三實施例的表面聲波裝置；  
第7圖顯示根據本發明之第四實
- 30.40.



施例的表面聲波裝置：

第 8 圖顯示根據本發明之第五實施例的表面聲波裝置；

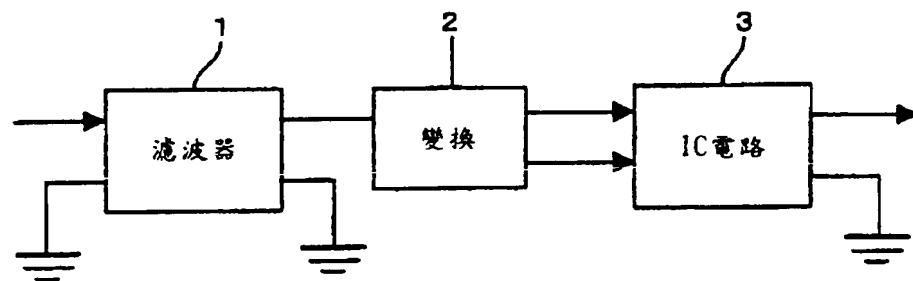
第 9 圖顯示根據本發明之第六實施例的表面聲波裝置；

第 10 圖顯示根據本發明之第七實

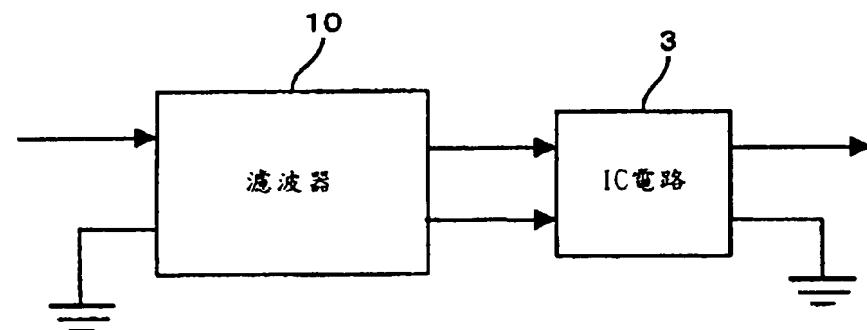
施例的表面聲波裝置：

第 11 圖顯示根據本發明之第八實施例的表面聲波裝置；以及

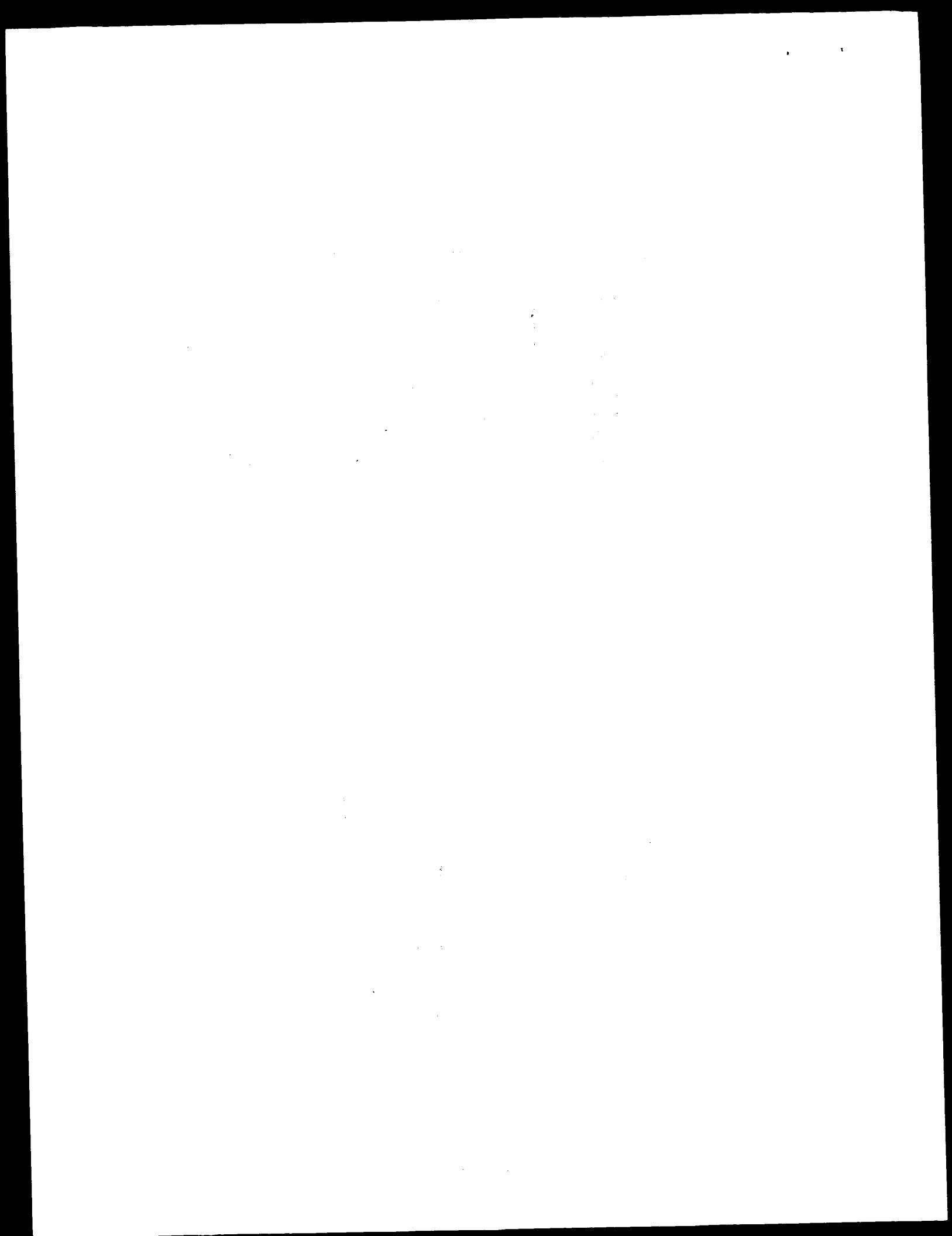
5. 第 12 圖顯示根據本發明之第九實施例的表面聲波裝置。



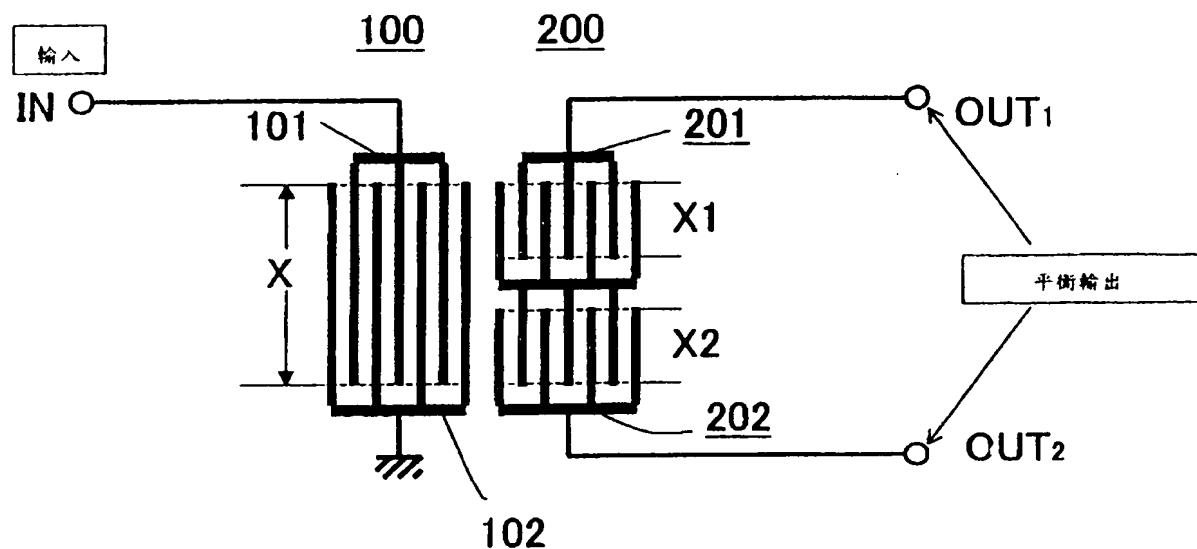
第 1 圖



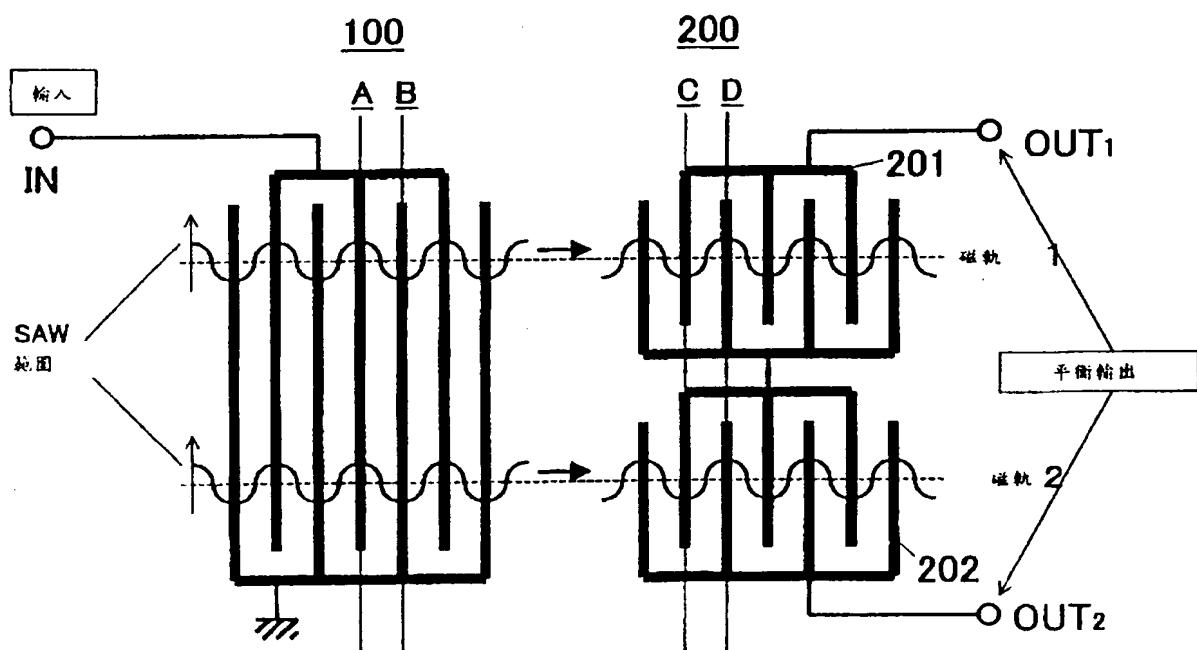
第 2 圖



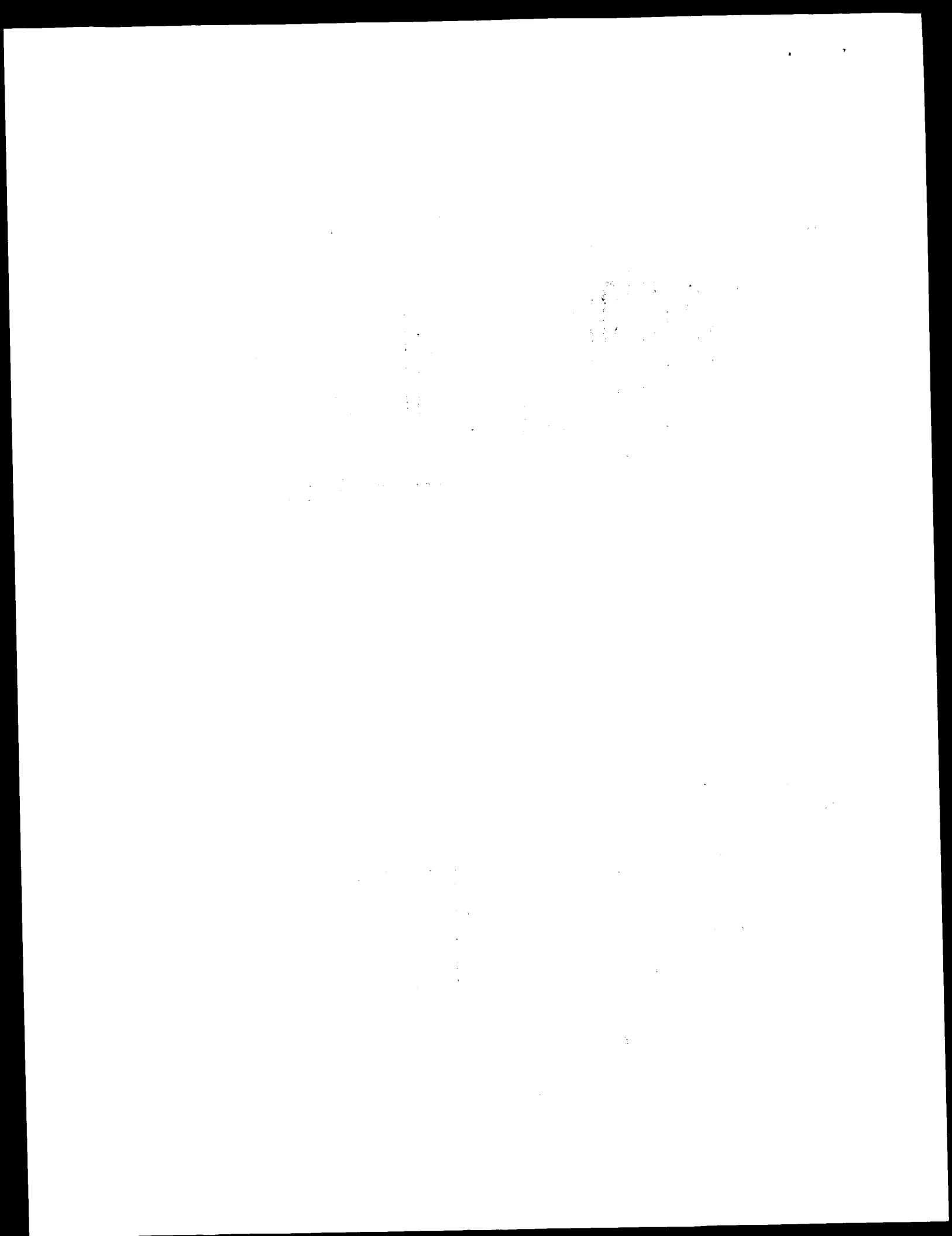
(4)



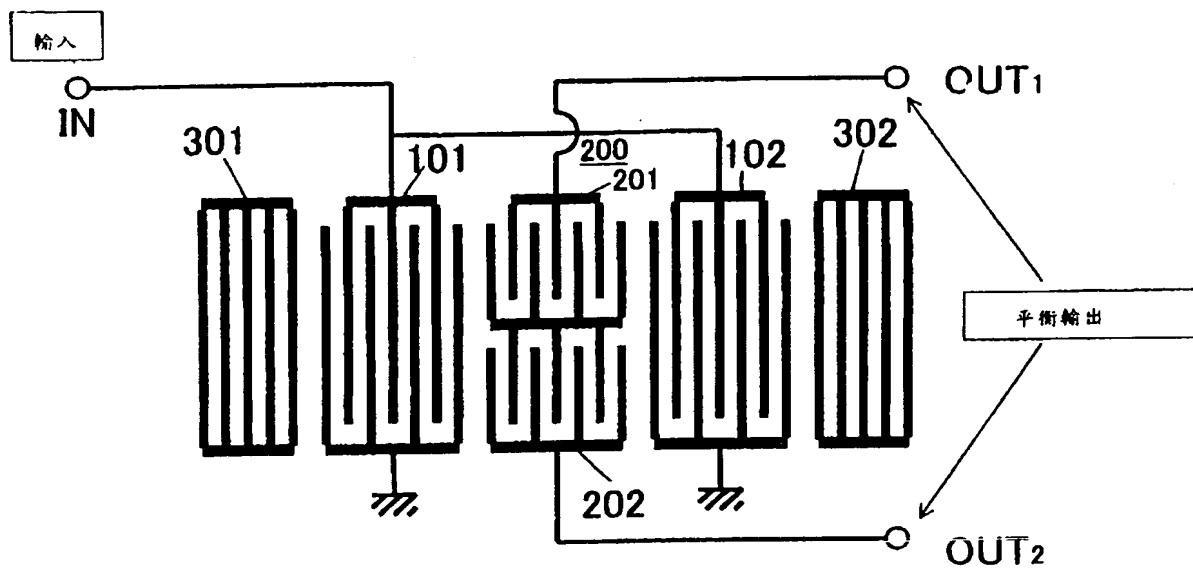
第3圖



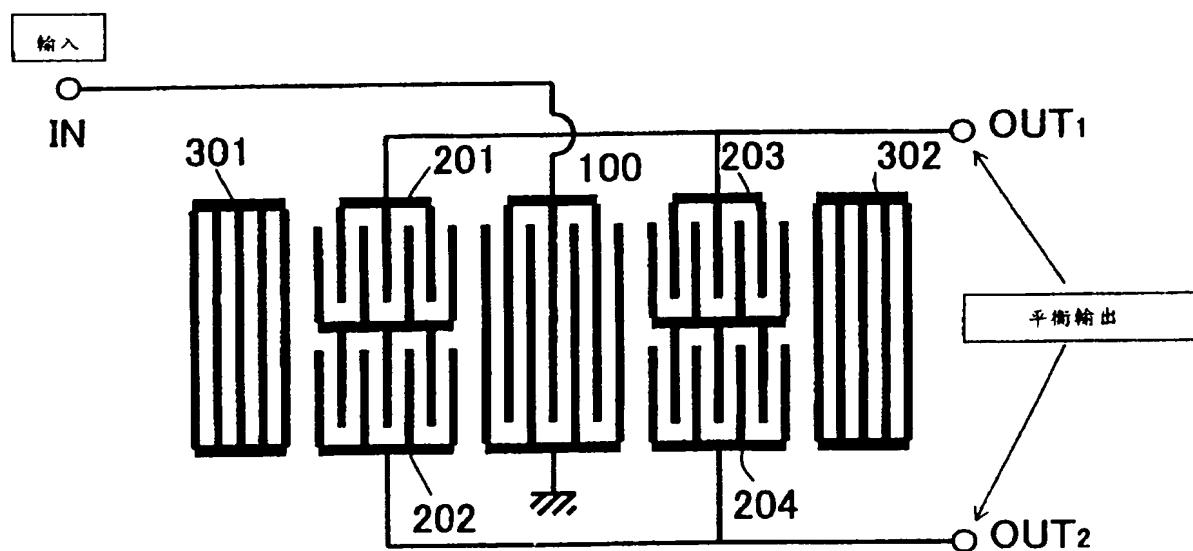
第4圖



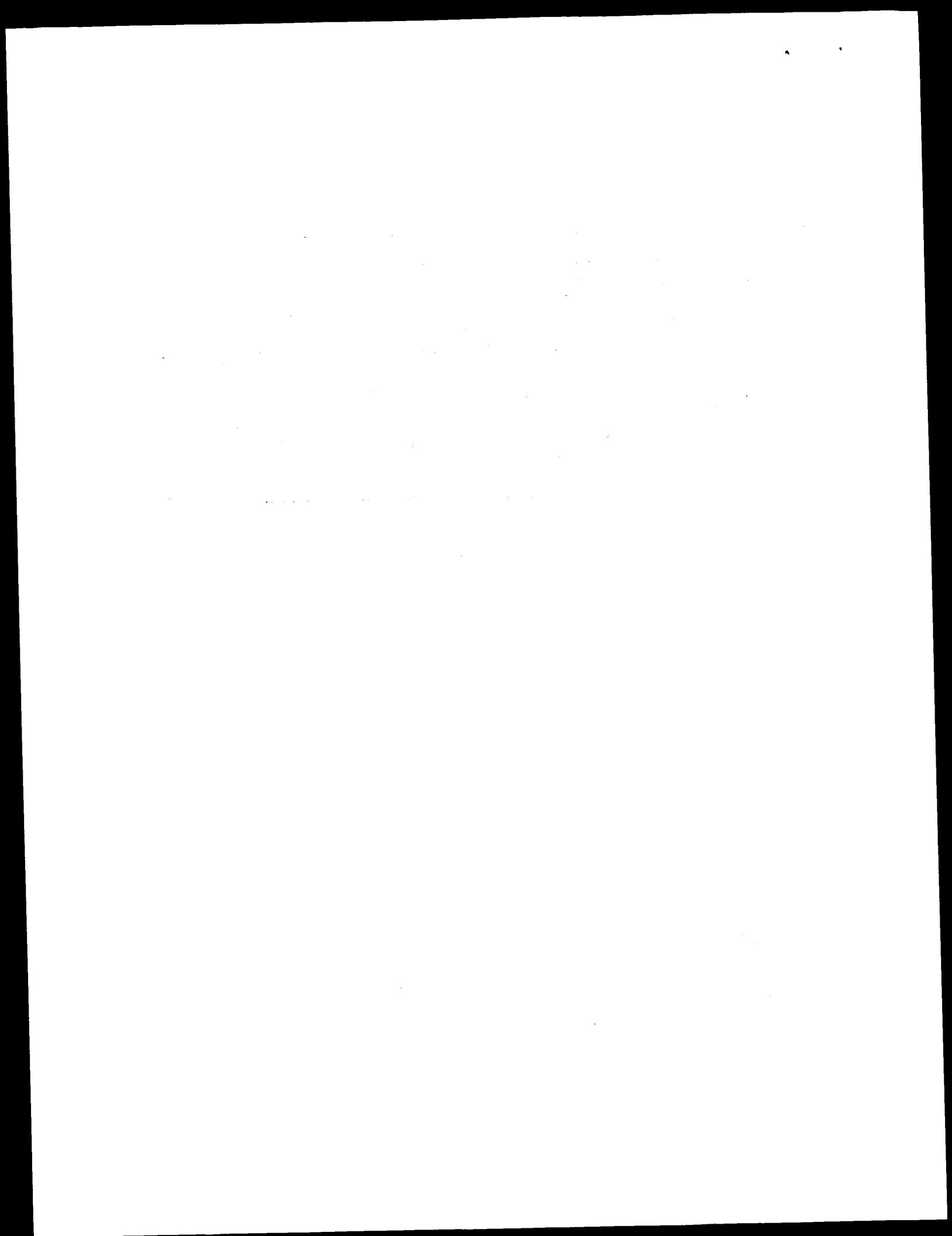
(5)



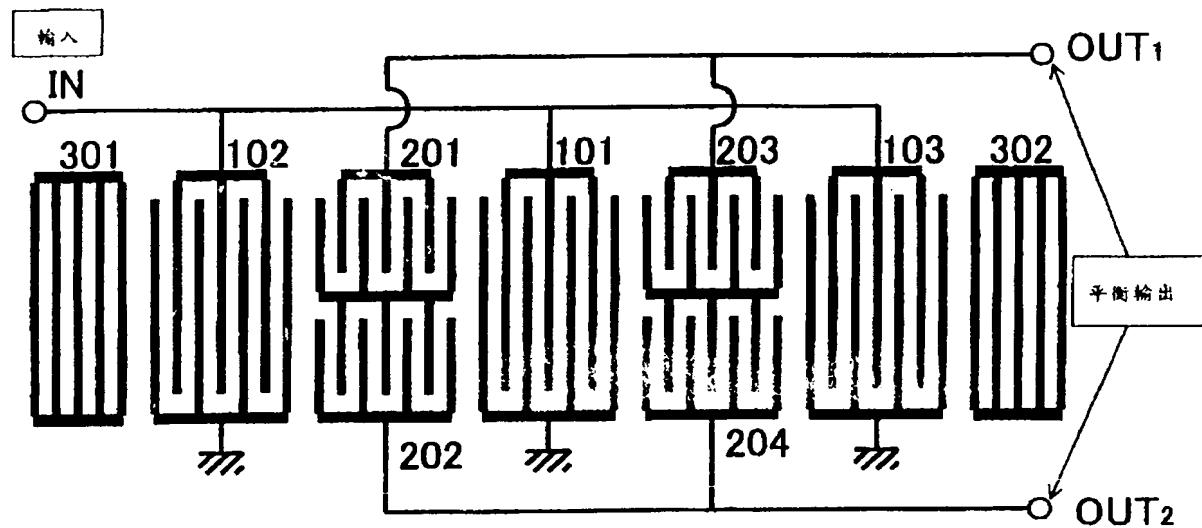
第 5 圖



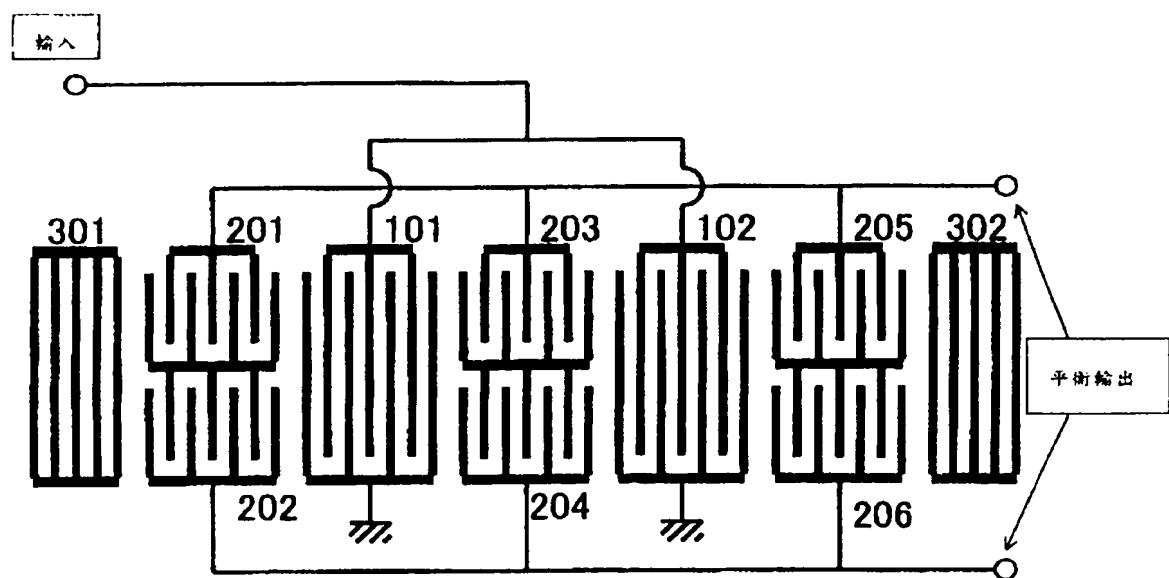
第 6 圖



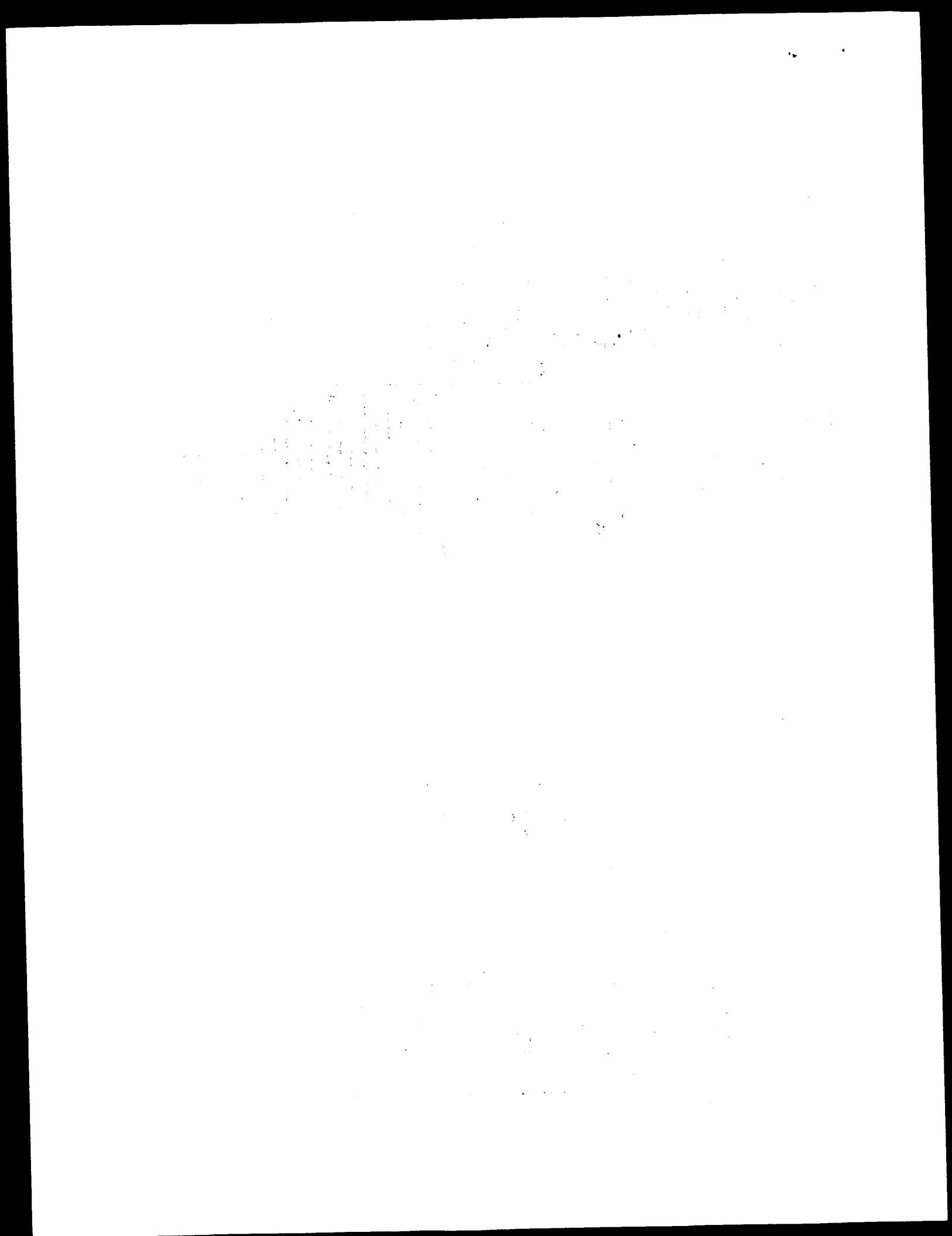
(6)



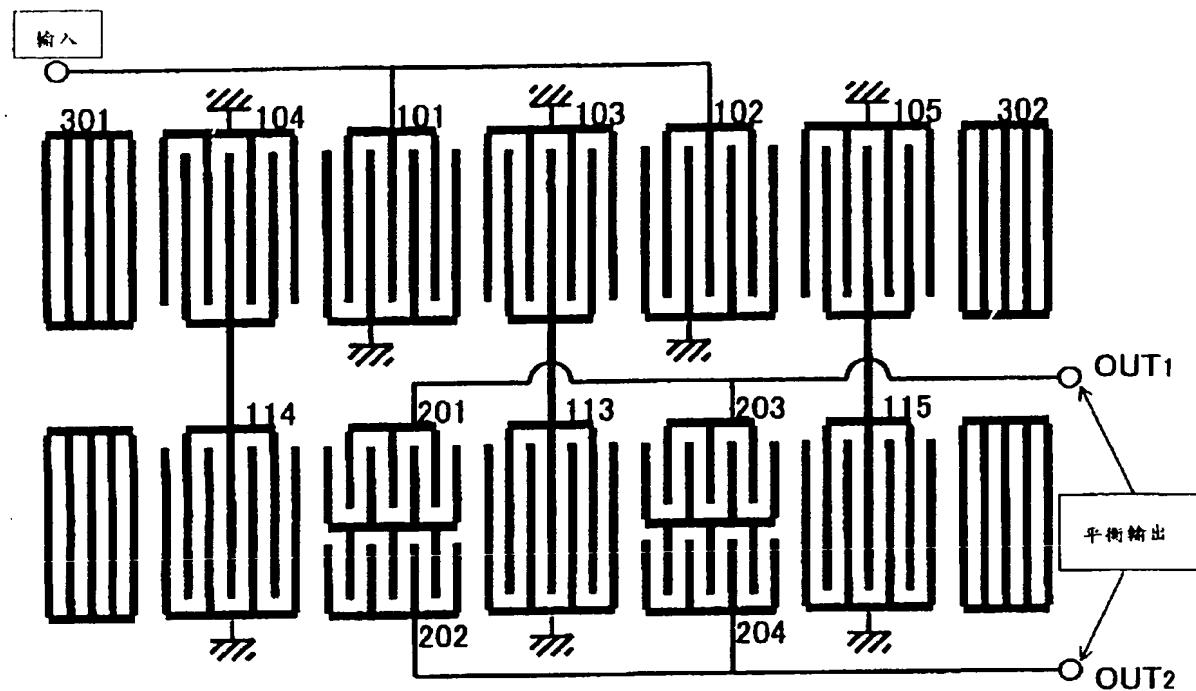
第 7 圖



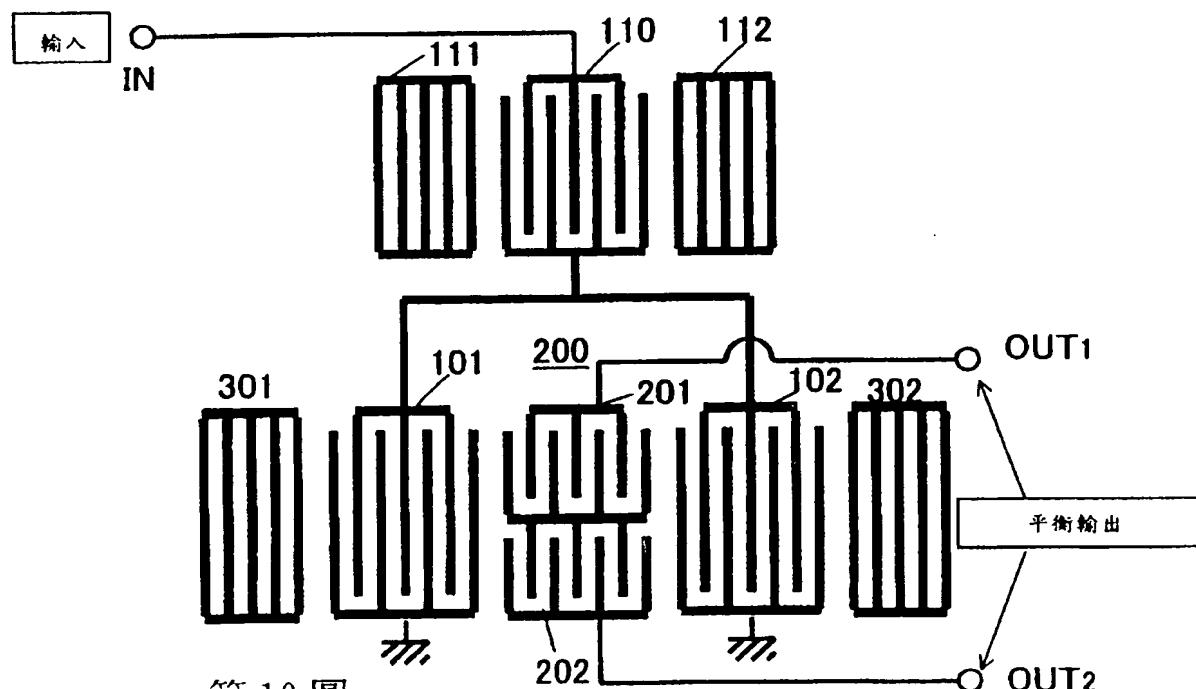
第 8 圖



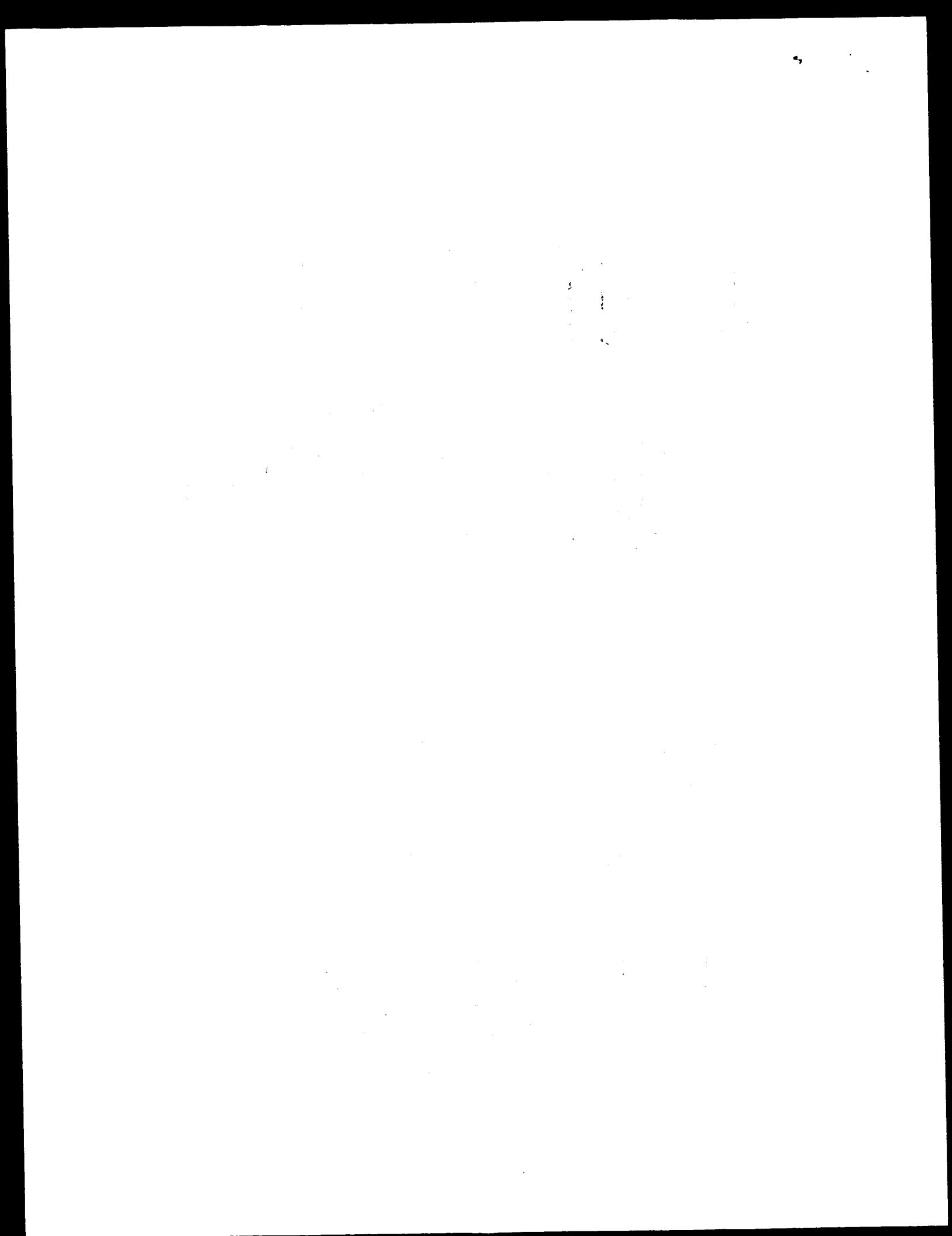
(7)

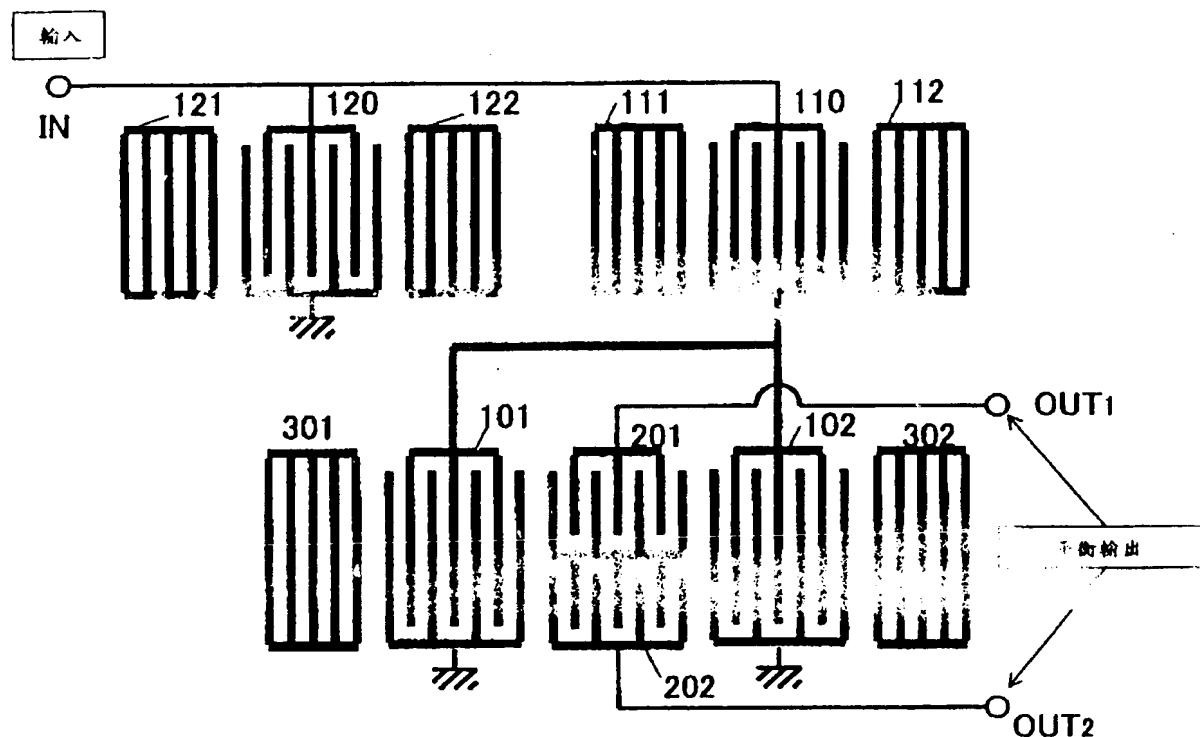


第 9 圖

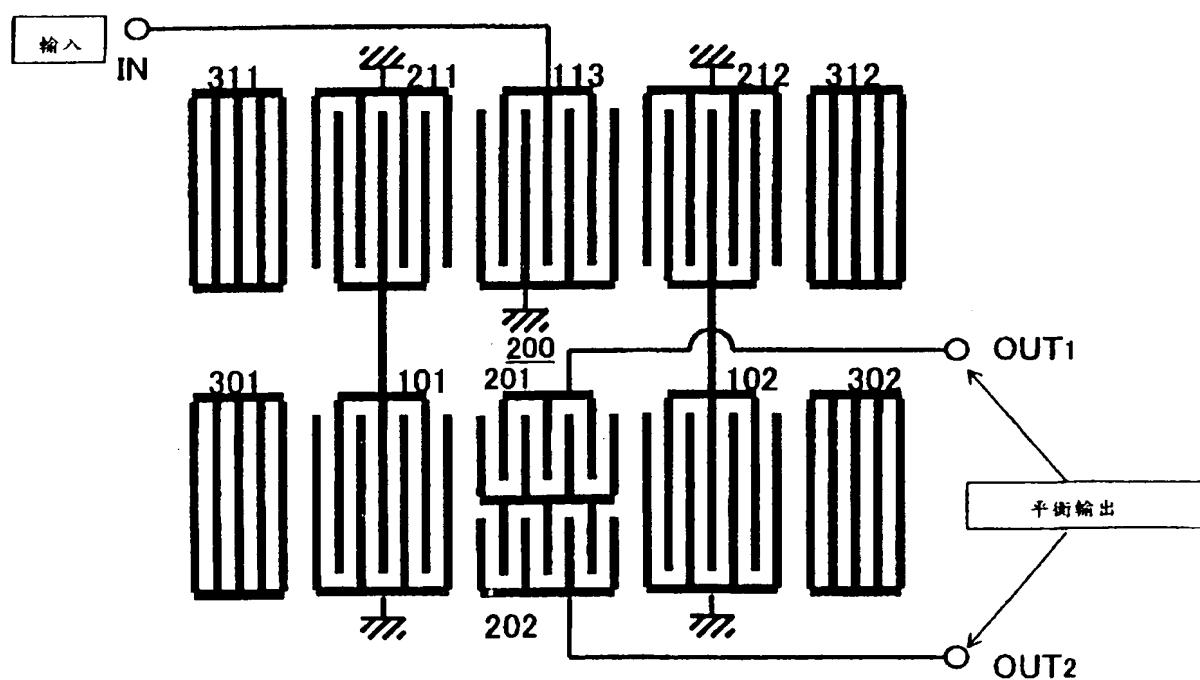


第 10 圖

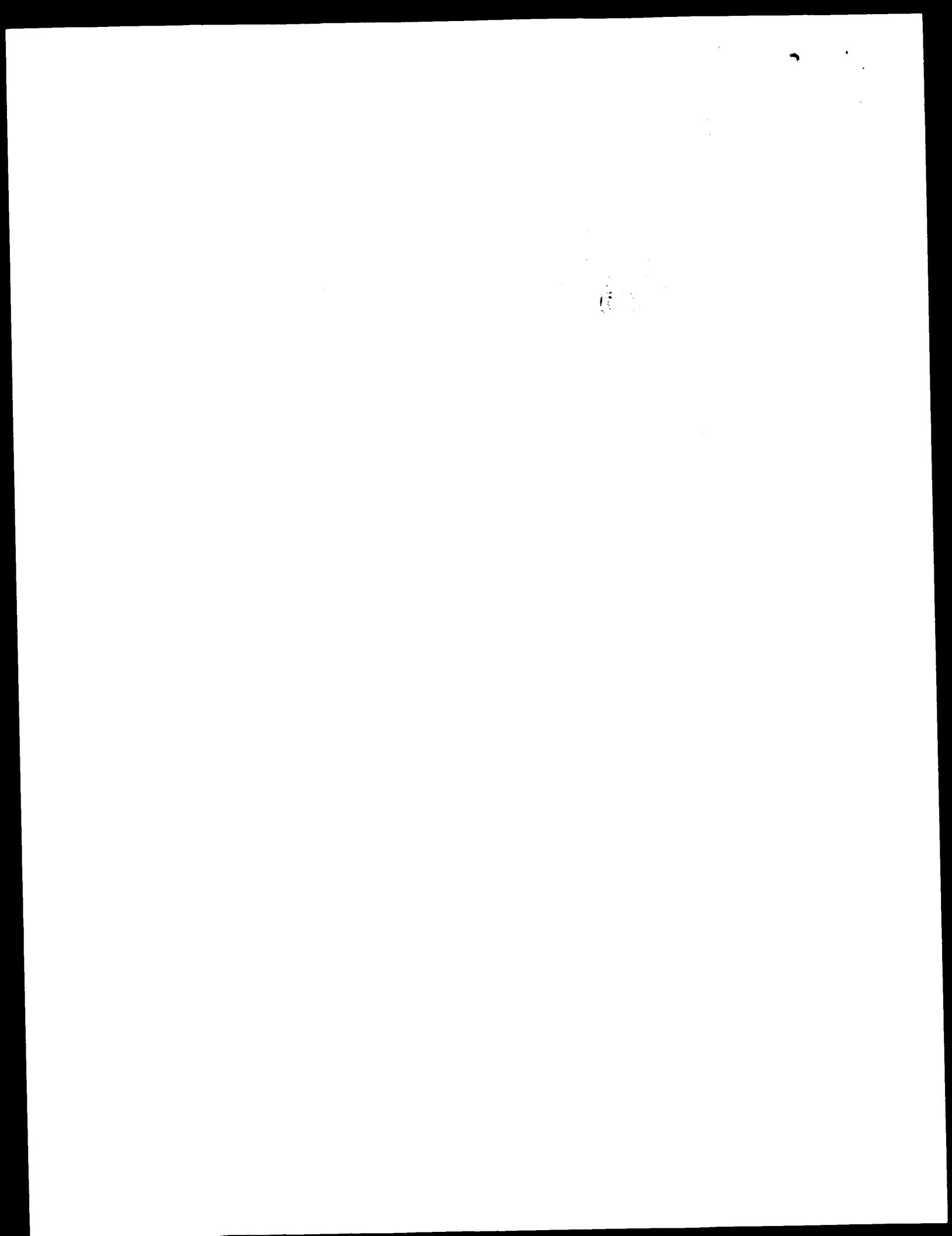




第 11 圖



第 12 圖



双面影印

## 公告本

申請日期	90.7.23
案 號	90104259
類 別	H03H 9/45, H01L 41/09

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(以上各欄由本局填註)

## 發明專利說明書

一、發明 名稱 	中 文	表面聲波裝置
	英 文	SURFACE ACOUSTIC WAVE DEVICE
二、發明人 	姓 名	(1)遠藤剛 (2)川內治 (3)上田政則
	國 籍	日 本
	住、居所	(1)～(3)日本國長野縣須坂市大字小山460番地
三、申請人	姓 名 (名稱)	日商・富士通媒體裝置股份有限公司
	國 籍	日 本
	住、居所 (事務所)	日本國長野縣須坂市大字小山460番地
	代表人 姓 名	白川達男

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## 四、中文發明摘要 (發明之名稱：表面聲波裝置 )

一種表面聲波裝置，其包含一輸入指間轉換器與一輸出指間轉換器，該裝置配置在一壓電基體的一表面聲波傳遞路徑上，其中當輸入或輸出指間轉換器之一的電極指孔徑長度以X代表時，該輸入或輸出指間轉換器有二個分開指間轉換器，每個轉換器均有電極指，電極指中的每個孔徑長度實質上以X/2代表，其中該二個分開指間轉換器是串列連接的，而個別電極指的電極均引導自二個分開指間轉換器並且被配置，以使連接到一平衡端子對的二個輸入與輸出信號具有相差180°的相位。

(請先閱讀背面之注意事項再填寫本頁各欄)

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## 英文發明摘要 (發明之名稱：Surface Acoustic Wave Device )

A surface acoustic wave device includes an input interdigital transducer and an output interdigital transducer, disposed on a surface acoustic wave propagation path of a piezoelectric substrate, wherein when an aperture length of an electrode finger of the input or output interdigital transducer is denoted by X, the output or input interdigital transducer has two divided interdigital transducers having the electrode finger in which each aperture length is denoted by substantially X/2, wherein the two divided interdigital transducers are serial-connected, and the electrodes of the respective electrode fingers are led from the two divided interdigital transducers, and are disposed so that two output and input signals connected to a balance terminal pair have a different phase at 180°.

由本局填寫	承辦人代碼：
	大類：
	I P C 分類：

A6

B6

本案已向：

日本 國(地區) 申請專利，申請日期： 案號：  有  無主張優先權  
 2000,06,30 特願2000-199279

(請先閱讀背面之注意事項再填寫本頁各欄)

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有關微生物已寄存於： ，寄存日期： ，寄存號碼：

## 五、發明說明 ( 1 )

### 發明之技術領域

本發明係有關一種表面聲波裝置，更確切來說，係有關一種表面聲波裝置，其輸入端與輸出端之任一具有平衡端子對或差分端子對。

(請先閱讀背面之注意事項再填寫本頁)

### 相關技藝之說明

表面聲波裝置被廣泛使用為一無線裝置之高頻電路的一濾波器，該無線裝置如一可攜式電話等。近年來，在無線裝置的高頻電路中，已經開始使用具有一平衡或差分輸入端與輸出端的一積體電路元件(IC)。

相反地，使用傳統表面聲波裝置的濾波器(以下稱為一表面聲波濾波器)於 I/O 端當中是不平衡的。於此，如第 1 圖所示，當與一混合器電路 IC 3 連接時，被稱為一平衡-不平衡變換器的不平衡-平衡變換部分，或由分開部件所組成之一變換電路 2 在一表面聲波濾波器 1 與混合器 IC 3 之間便是必須的。

再者，表面聲波濾波器往往具有  $50\Omega$  的 I/O 阻抗，另一方面，在許多狀況下，具有一平衡端子對之混合器電路 IC 3 的阻抗，則高達約  $100$  至  $200\Omega$ ，且對連接 IC 與表面聲波濾波器來說，一阻抗變換電路是必須的。

然而，以上增加了在無線裝置中電路部件的使用。此外，對縮小尺寸越來越高的需求，一種節省

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## 五、發明說明 ( 2 )

空間的設計便是需要的。

### 發明之概要說明

因此，本發明的目的在於實現小尺寸的表面聲波裝置，其具有一不平衡-平衡變換功能與一種阻抗變換功能。

為了要達成上述目的，本發明的第一部份備置了一表面聲波裝置，其包含一輸入指間轉換器與一輸出指間轉換器，該裝置配置在一壓電基體之一表面聲波傳遞路徑上，其中當輸入或輸出指間轉換器之一的電極指孔徑長度以  $X$  代表時，該輸入或輸出指間轉換器有二個分開指間轉換器，每個轉換器均有電極指，電極指中的每個孔徑長度實質上以  $X/2$  代表，並且其中，該二個分開指間轉換器是串列連接的，而個別電極指的電極均引導自二個分開指間轉換器且被配置，以使連接到一平衡端子對的二個輸入與輸出信號具有相差  $180^\circ$  的相位。

為了要達到上述的目的，本發明之第二部分備置了一種表面聲波裝置，其包含組配在一壓電基體之一表面聲波傳遞路徑上的多個指間轉換器，與一個配置在二邊的反射電極，其中多個指間轉換器包含替代配置之第一種指間轉換器與第二種指間轉換器，其中當第一種指間轉換器之一的電極指孔徑長度以  $X$  代表時，每個第二指間轉換器具有二個分開

(請先閱讀背面之注意事項再填寫本頁)

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## 五、發明說明 ( 3 )

(請先閱讀背面之注意事項再填寫本頁)

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指間轉換器，每個轉換器均有一電極指，電極指中的每個孔徑長度實質上以  $X/2$  代表，並且其中，該第一種指間轉換器是連接到一不平衡輸入或輸出端子對，而該二個分開指間轉換器是串列連接的，而個別電極指的電極都是引導自二個分開指間轉換器，並且連接到一平衡端子對，二個分開指間轉換器的個別電極指被配置，以使平衡端子對中之信號相位相差  $180^\circ$ 。

較佳地，在本發明之第一或第二部份中，位於連接於平衡端子邊緣的電極指位置在二個分開指間轉換器中，以半波為單位相互滑移。

較佳地，在本發明的第二部份中，該多個指間轉換器以三個指間轉換器，構成一個雙重模式濾波器。

較佳地，在本發明的第二部份中，該多個指間轉換器以五個或更多個指間轉換器，構成一多重電極濾波器。

具有二個或多個濾波器的一表面聲波裝置為級聯連接的，其最外面的濾波器是由根據本發明之第一或第二部分的表面聲波裝置所組成，並具有一平衡端子對作為一輸入端或輸出端。

較佳地，本發明上述部份之該壓電基體可為一旋轉  $40$  至  $44^\circ$  的  $Y-X\text{-LiTaO}_3$ 。

另外，較佳地，本發明上述部份之壓電基體可

## 五、發明說明 ( 4)

為一旋轉 66 至 74° 的 Y-X LiNbO<sub>3</sub>。

由以下之說明並參照附錄之圖式，本發明的特徵將更為明顯。

(請先閱讀背面之注意事項再填寫本頁)

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### 圖示的簡要說明

第 1 圖說明當一傳統表面聲波裝置連接到一具有平衡輸入端的 IC 電路的情況；

第 2 圖說明作為本發明目的之一表面聲波裝置連接到一具有平衡輸入端的 IC 電路的情況；

第 3 圖顯示根據本發明之第一實施例的表面聲波裝置；

第 4 圖說明根據第 3 圖之實施例的操作；

第 5 圖顯示根據本發明之第二實施例的表面聲波裝置；

第 6 圖顯示根據本發明之第三實施例的表面聲波裝置；

第 7 圖顯示根據本發明之第四實施例的表面聲波裝置；

第 8 圖顯示根據本發明之第五實施例的表面聲波裝置；

第 9 圖顯示根據本發明之第六實施例的表面聲波裝置；

第 10 圖顯示根據本發明之第七實施例的表面聲波裝置；

## 五、發明說明 ( 5 )

第 11 圖顯示根據本發明之第八實施例的表面聲波裝置；以及

第 12 圖顯示根據本發明之第九實施例的表面聲波裝置。

(請先閱讀背面之注意事項再填寫本頁)

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### 較佳實施例的說明

以下，將參照附錄的圖式來說明本發明之實施例。以下較佳實施例的說明是為了要了解本發明的內容，但本發明之保護範圍並不限於本發明之實施例、圖式與說明。

第 2 圖顯示根據本發明之表面聲波裝置的一適用實例，其相似於第 1 圖引導至一混合器電路 IC 3。

根據本發明之表面聲波裝置具有一不平衡-平衡變換功能與一阻抗變換功能。因此，可能可設定該混合器電路 IC 3 的一平衡輸入端為一輸入阻抗。因此，可以不要使用獨立的不平衡-平衡變換功能與阻抗變換功能電路，其在第 1 圖是必要的。因此，可能可以縮小裝置尺寸。

第 3 圖顯示根據本發明之第一實施例並用於第 2 圖中之實例的表面聲波裝置 10 的一電極結構。

在第 3 圖中，一單一的輸入指間轉換器 (IDT) 100 與一輸出指間轉換器 (IDT) 200 都配置在表面聲波裝置的傳遞路徑，其形成於將在稍後詳細說明之一壓電基體上。

## 五、發明說明 ( 6 )

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位於輸入 IDT 100 之一邊的第一指間電極指 101 連接到一輸入信號端子 IN，而一反第二指間電極指 102 則是接地的。被第一電極指 101 與第二電極指 102 重疊的寬度  $X$  為輸入 IDT 100 的一孔徑長度。

另一方面，輸出 IDT 200 具有第一與第二指間或跨接指間轉換器 (IDT) 201、202，其孔徑長度  $X_1$ 、 $X_2$  實質上為輸入 IDT 100 的孔徑寬度  $X$  之範圍的孔徑長度  $X$  的一半。

第一跨接 IDT 201 的一電極指與第二跨接 IDT 202 的一電極指均分別連接到平衡端子對 OUT 1、OUT 2，而第一與第二跨接 IDTs 201、202 的其他電極指則被組配，以便分別共同的連接。

此處，特別的是，第一與第二 IDTs 201、202 的其他電極被組配，以使其位置於電極指位置中相互滑移一週期，即互相滑移二分之一的表面聲波波長。

第 4 圖說明第 3 圖之電極指的操作原則，特別地，典型的顯示表面聲波 (以下稱為 SAW) 在一輸入端與一輸出端之間的傳遞行為。在此，二個分開輸出端 IDTs 201、202 的上部分被稱為磁軌 1，而其下部分則被稱為磁軌 2。

現在考量表面聲波裝置運作的某一特定時刻。首先，利用輸入 IDT 100 將一輸入電子信號轉換為 SAW。該 SAW 在壓電基體上傳遞。再者，該 SAW

## 五、發明說明 ( 7 )

入射在輸出 IDT 200 的第一與第二跨接 IDTs 201、202 上，作為磁軌 1 與磁軌 2。在第 4 圖中，磁軌 1 與 2 的每個 SAW 範圍都將顯示出來。

當 SAW 入射在磁軌 1 與 2 上時，SAW 被再次變換成一個電子信號。此時，電極指的位置便介於磁軌 1 與 2 之間，以半波為單位滑動。於此，由輸出端子對 OUT1、OUT2 所取得之電子信號的相位便滑動  $180^\circ$ ，可接受之偏差為  $\pm 10^\circ \sim 15^\circ$ 。

換言之，在第 3 圖的實施例中，可理解的是一平衡端子對將形成於輸出端子對 OUT1 與 OUT2 之間，並且完成一個不平衡輸入-平衡輸出。接下來，I/O 阻抗將被考量。一電容阻抗形成於 IDT 的電極指之間，而電容阻抗的強度則根據電極指與孔徑長度之間的間隔來決定。

在第 4 圖中，介於輸入 IDT 100 電極指之間的間隔 A-B 等於輸出 IDT 200 電極指之間的間隔 C-D。因此，當輸入阻抗為  $50\Omega$  時，由於 IDT 201 的阻抗位於磁軌 1 的邊緣，IDT 201 的孔徑長度  $X_1$  則大約是輸入 IDT 100 的孔徑長度  $X$  的一半，而阻抗將變為二倍，或大約為  $100\Omega$ 。

另一方面，位於磁軌 2 邊緣的 IDT 202 的阻抗將相似的變成約  $100\Omega$ 。因此，當於平衡端子段 OUT 1 與 OUT 2 之間進行觀察時，由於二個輸出 IDTs 201 與 202 均是級聯連接的，輸出端的整個阻抗將變為

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## 五、發明說明 ( 8 )

200Ω。因此，便有可能將 I/O 阻抗從 50Ω 變換到 200Ω。

第 5 圖顯示根據本發明之第二實施例的表面聲波裝置。第 5 圖所顯示之形成於壓電基體上之 IDT 的電極指組態與第 3 圖的相似。二個輸入 IDT 101 與 102 與一輸出 IDT 200 被配置，以便被夾住。再者，二邊均包含反射器 301 與 302，形成一個所謂的雙重模式濾波器組態。

在此，根據本發明，當輸出 IDT 200 利用與第 3 圖實例相同的方式被分成上與下二個 IDT 201 與 202 時，從當中提取的信號為介於端子對 OUT1 與 OUT2 之間的平衡輸出。

當使用該雙重模式濾波器時，便可能可以實現具有高衰減之不平衡-平衡濾波器。

再者，在第 5 圖的實施例中，阻抗變換功能與第 4 圖中所說明的相同。

第 6 圖為本發明之第三實施例，其並且顯示與前例相同方式形成之在壓電基體上形成的 IDT 電極指組態。此實施例同時具有一雙重模式濾波器組態。它的特徵在於 IDTs 的二個組合 (IDTs 201 與 202，以及 IDTs 203 與 204) 都於一輸出端被使用，其位於第 5 圖之實施例相反的位置。

在此可以取得與第二實施例中相同的特徵，並且當輸入阻抗較佳地被設定為低於第二實施例中的

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## 五、發明說明 ( 9 )

阻抗時是有效的。換言之，如上所述，當使用 IDTs 的二個組合 (IDTs 201 與 202，以及 IDTs 203 與 204) 時，便平行連接到平衡輸出端子對 OUT1 與 OUT2。

因此，當輸入 IDT 100 的 I/O 阻抗為  $50\Omega$  時，在第 6 圖的較佳實施例中，輸出阻抗將變為  $100\Omega$ 。

第 7 圖顯示根據本發明之第四實施例，其並具有一多重電極型態之表面聲波濾波器，其包含 5 個 IDTs，其中三輸入 IDTs 101 至 103 與二組輸出 IDTs 201 至 202，與 203 至 204 都是交替配置的。

大體而言，多重電極型態可被界定為包含多個 (三個或更多) IDTs。第 6 圖之雙重模式型態的實施例對應於包含多重電極型態中之最小 IDTs。

在此，在此配置中，二組輸出 IDTs 201 至 202 與 203 至 204 的每個輸出端都被引導到平衡輸出端子對 OUT1 與 OUT2。在本實施例的配置中，可能可以實現相對寬廣通帶寬度的一平衡濾波器。

第 8 圖顯示根據本發明之第五實施例，其並顯示與前例相同方式形成之在壓電基體上形成的 IDT 電極指組態。

第五實施例與第 7 圖之實施例相同之處在於使用多重電極組態，但三組輸出 IDTs 201 至 202、203 至 204 與 205 至 206 都是使用在輸出端。可以取得與第 7 圖中相同的特徵，並且當輸入阻抗較佳地設定為低於第 7 圖之實施例的阻抗時是有效的。

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## 五、發明說明 ( 10 )

第 9 圖顯示根據本發明之第六實施例，其並顯示與前例相同方式形成之在壓電基體上形成的 IDT 電極指組態。利用二階段級聯連接來組配該多重型態電極指。換言之，第一階段 IDTs 103 至 105 都是級聯連接於第二階段 IDTs 113 至 115。

再者，由於濾波器的輸出 IDT 值於第二階段，二組 IDTs 201 至 202 與 203 至 204 便被使用。二組輸出 IDTs 201 至 202 與 203 至 204 的輸出端被提取到平衡輸出端子對 OUT1 與 OUT2。

當使用此種組配時，由於級聯連接是進行於第一階段與第二階段，較佳地的是能大量移出衰減量。

第 10 圖顯示根據本發明之第七實施例，其並顯示與前例相同方式形成之在壓電基體上形成的 IDT 電極指組態。第七實施例與第 5 圖實施例相同之處在於串列共振器，其被組配以便在雙重模式濾波器的輸入端具有級聯連接之 IDT 110 與反射 IDTs 111 與 112。

此實施例的特徵在於藉由適當地設定串列共振器的頻率，通帶附近之高頻的一邊的衰減量將被大量的移除。

第 11 圖顯示根據本發明之第八實施例，其並且顯示與前例相同方式形成之在壓電基體上形成的 IDT 電極指組態。第 11 圖實施例為第 10 圖實施例

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## 五、發明說明 ( 1 )

的延伸，並且被組配以使具有 IDT 120 與反射 IDTs 121 與 122 之串列共振器更進一步平行連接，至於具有 IDT 100 與反射 IDTs 111 與 112 之串列共振器，其在雙重模式濾波器的輸入端，級聯連接到一所謂梯形濾波器。

在此配置中，通帶附近之高頻一邊的衰減量能大量移除，且不會使通帶中的插入損耗變質，並可以實現一平衡濾波器。

第 12 圖顯示根據本發明之第九實施例，其並且顯示與前例相同方式形成之在壓電基體上形成的 IDT 電極指組態。該雙重模式濾波器是級聯連接的。第一階段中的雙重模式濾波器利用 IDT 113 連接到一輸入端子 IN、輸出 IDTs 211 與 212，以及反射 IDTs 311 與 312。

第一階段之雙重模式濾波器的輸出 IDTs 211 與 212 連接到第二階段之雙重模式濾波器的輸入 IDTs 101 與 102。組配此實施例以使第二階段之雙重模式濾波器的輸出 IDT 200 被分成 IDTs 201 與 202。

在此實施例中，通帶插入耗損是小的，並且有可能實現具有高衰減特性的平衡濾波器。

於此，在個別的實施例中，已說明了組配 IDTs 的電極指是形成並且配置在壓電基體上的。由於壓電基體中之可傳遞表面聲波耗損被最小化，其並且具有寬廣帶寬，本發明之發明人已在日本早期公開

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## 五、發明說明 ( 12 )

案 8-179551 中揭示過此特性了。因此，所欲的是先前所揭示之壓電基體也同時使用在本發明中。

該較佳的壓電基體為一旋轉 40 至 44° 的 Y-X LiTaO<sub>3</sub>，其從 LiTaO<sub>3</sub> 單一晶體中被剪除，以一個旋轉角繞者 X 軸旋轉，從 Y 軸到 Z 軸，該旋轉角介於 40 至 44° 的範圍。一旋轉 66 至 74° 的 Y-X LiTaO<sub>3</sub> 也是較佳的，其從 LiNbO<sub>3</sub> 單一晶體中被剪除，以一個旋轉角繞者 X 軸旋轉，從 Y 軸到 Z 軸，該旋轉角介於 66 至 74° 的範圍。

再者，本發明之說明已經詳述出輸入端是不平衡的而輸出端是平衡的情況，以及較佳實例中如何使用表面聲波裝置，但這是具有可逆性的，並且也有可能可以調整本發明之表面聲波裝置的輸入端為平衡，且調整其輸出端為不平衡的。

上述說明之實施例請參照附錄的圖式，根據本發明可以實現具有一不平衡-平衡變換功能的表面聲波裝置，以及介於不平衡-平衡端子間的阻抗變換功能。

因此，本發明可以提供一種上面配置有表面聲波裝置之小尺寸組態通訊裝置。

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## 五、發明說明 ( 13 )

元件標號對照表

1	表面聲波濾波器	201	第一跨接指間轉換器 (IDT)
2	變換電路	202	第二跨接指間轉換器 (IDT)
3	混合器 IC	203	輸出 IDT
10	表面聲波裝置	204	輸出 IDT
100	輸入指間轉換器 (IDT)	205	輸出 IDT
101	第一指間電極指	206	輸出 IDT
102	第二電極指	211	輸出 IDT
103	輸入 IDT	212	輸出 IDT
104	輸入 IDT	301	反射器
105	輸入 IDT	302	反射器
113	輸入 IDT	311	反射 IDT
114	輸入 IDT	312	反射 IDT
115	輸入 IDT	IN	輸入端子
110	IDT	OUT1	輸出端子對
111	反射 IDT	OUT2	輸出端子對
112	反射 IDT		
120	IDT		
121	反射 IDT		
122	反射 IDT		
200	輸出指間轉換器 (IDT)		

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## 六、申請專利範圍

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1. 一種表面聲波裝置，其包含一輸入指間轉換器與一輸出指間轉換器，該裝置配置在一壓電基體的一表面聲波傳遞路徑上，其中  
當輸入或輸出指間轉換器之一的電極指孔徑長度以  $X$  代表時，該輸入或輸出指間轉換器有二個分開指間轉換器，每個轉換器均有電極指，電極指中的每個孔徑長度實質上以  $X/2$  代表，並且其中，該二個分開指間轉換器是串列連接的，而個別電極指的電極均引導自二個分開指間轉換器且被配置，以使連接到一平衡端子對的二個輸入與輸出信號具有相差  $180^\circ$  的相位。
2. 一種表面聲波裝置，其包含組配在一壓電基體之一表面聲波傳遞路徑上的多個指間轉換器，與一個配置在二邊的反射電極，其中  
多個指間轉換器包含替代配置之第一種指間轉換器與第二種指間轉換器，其中  
當第一種指間轉換器之一的電極指孔徑長度以  $X$  代表時，每個第二指間轉換器具有二個分開指間轉換器，每個轉換器均有一電極指，電極指中的每個孔徑長度實質上以  $X/2$  代表，並且其中，該第一種指間轉換器是連接到一不平衡輸入或輸出端子對，而該二個分開指間轉換器是串列連接的，而個別電極指的電極都是引導自二個分開指間轉換器，並且連接到一平衡端子對，二個分開

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指間轉換器的個別電極指被配置，以使平衡端子對中之信號相位相差  $180^\circ$ 。

3. 如申請專利範圍第 1 項之裝置，其中  
在該二個分開指間轉換器中，位於連接於該平衡端子邊的電極指位置以半波為單位互相滑移。
4. 如申請專利範圍第 2 項之裝置，其中  
在該二個分開指間轉換器中，位於連接於該平衡端子邊的電極指位置以半波為單位互相滑移。
5. 如申請專利範圍第 2 項之裝置，其中  
多個指間轉換器利用三個指間轉換器，構成一個雙重模式濾波器。
6. 如申請專利範圍第 2 項之裝置，其中  
該多個指間轉換器為五個或更多個指間轉換器，其構成一個多重電極濾波器。

7. 一種表面聲波裝置，其包含：  
二個或更多個級聯連接的濾波器，其最外面的濾波器包含，  
一輸入指間轉換器與一輸出指間轉換器，其配置在一壓電基體的一表面聲波傳遞路徑上，其中  
當輸入或輸出指間轉換器之一電極指的孔徑長度以  $X$  代表時，該輸入或輸出指間轉換器有二個分開指間轉換器，每個轉換器均有電極指，電極指中的每個孔徑長度實質上以  $X/2$  代表，並且其中該二個分開指間轉換器是串列連接的，而個別電

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極指的電極均引導自二個分開指間轉換器且被配置，以使連接到一平衡端子對的二個輸入與輸出信號具有相差  $180^\circ$  的相位；以及  
被使用作為一輸入端或輸出端的一平衡端子對。

## 8. 一種表面聲波裝置，其包含：

二個或更多個級聯連接的濾波器，其最外面的濾波器包含，

組配在一壓電基體之一表面聲波傳遞路徑上的多個指間轉換器，與一個配置在二邊的反射電極，  
其中

該多個指間轉換器包含交替配置的第一種指間轉換器與第二種指間轉換器，其中

當第一種指間轉換器之一電極指的孔徑長度以  $X$  代表時，每個第二指間轉換器具有二個分開指間轉換器，每個轉換器均有一電極指，電極指中的每個孔徑長度實質上以  $X/2$  代表，並且其中，

該第一種指間轉換器是連接到一不平衡輸入或輸出端子對，而該二個分開指間轉換器是串列連接的，而個別電極指的電極都是引導自二個分開指間轉換器，並且連接到一平衡端子對，二個分開指間轉換器的個別電極指被配置，以使一平衡端子對中之信號相位相差  $180^\circ$ ；以及

被使用作為一輸入端或輸出端的一平衡端子對。

## 9. 如申請專利範圍第 1 到第 8 項之任一項的表面

## 六、申請專利範圍

聲波裝置，其中

該壓電基體可為一旋轉 40 至 44° 的 Y-X LiTaO<sub>3</sub>。

10. 如申請專利範圍第 1 到第 8 項之任一項的表面

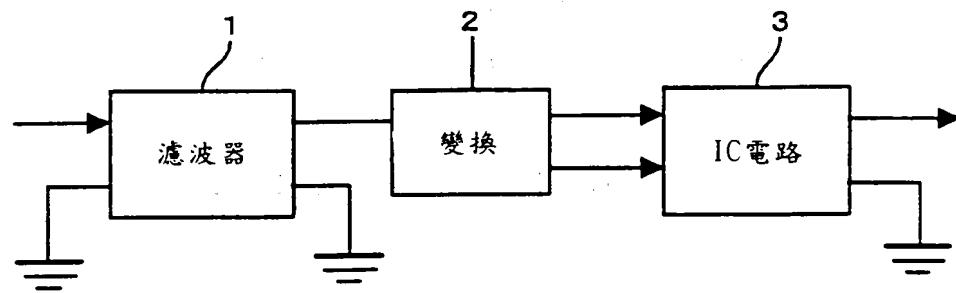
聲波裝置，其中

該壓電基體可為一旋轉 66 至 74° 的 Y-X LiNbO<sub>3</sub>。

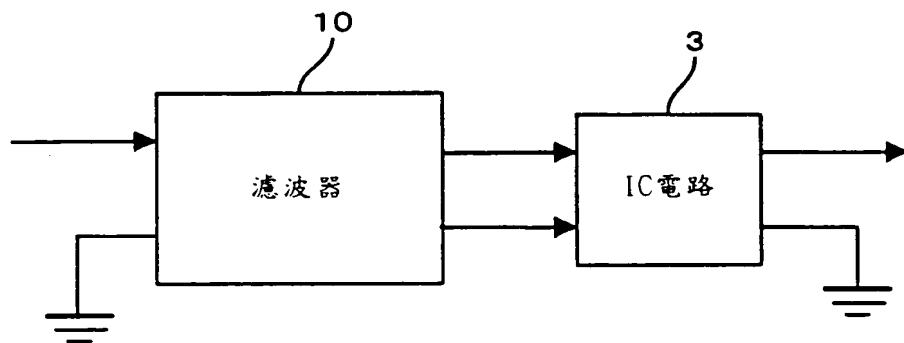
(請先閱讀背面之注意事項再填寫本頁)

裝  
訂  
線

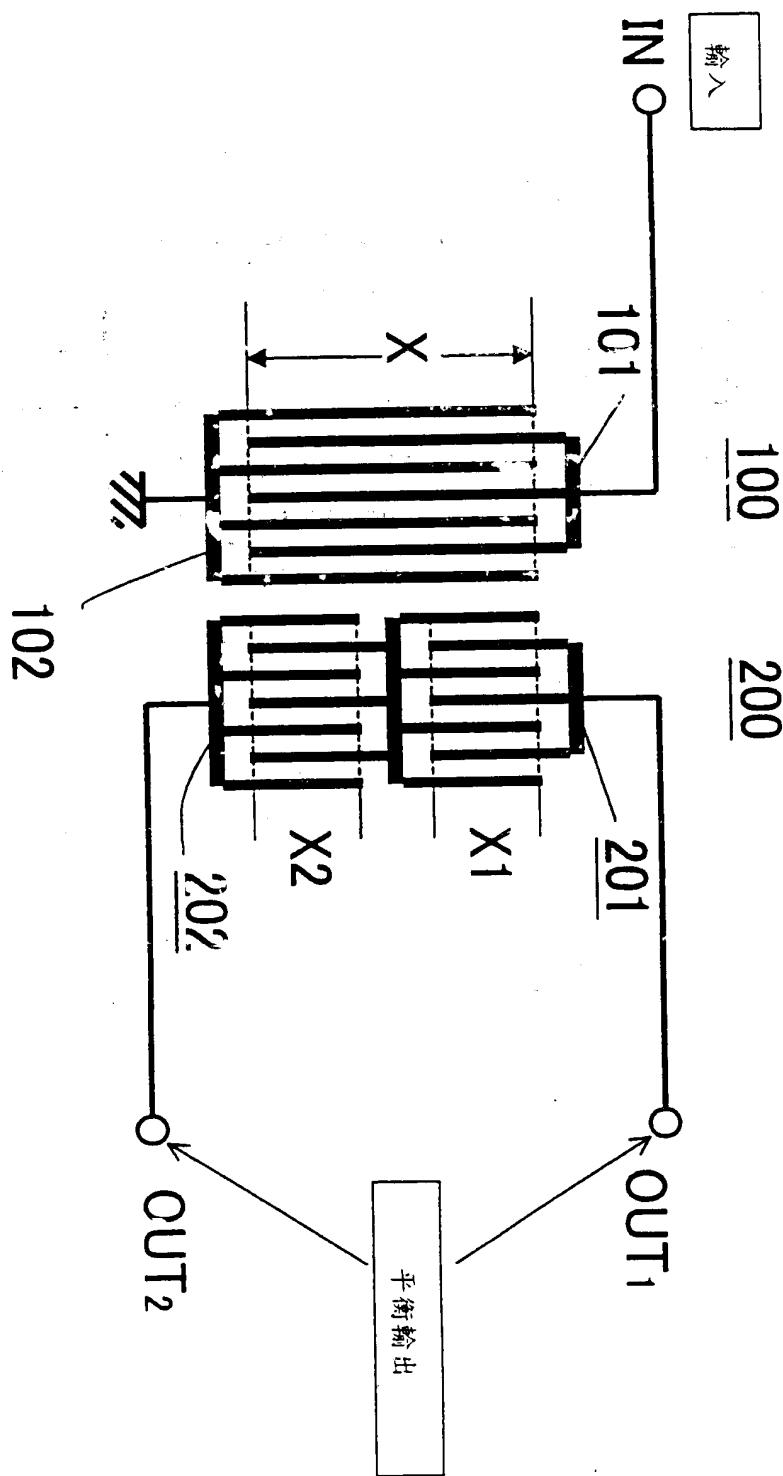
第 1 圖



第 2 圖



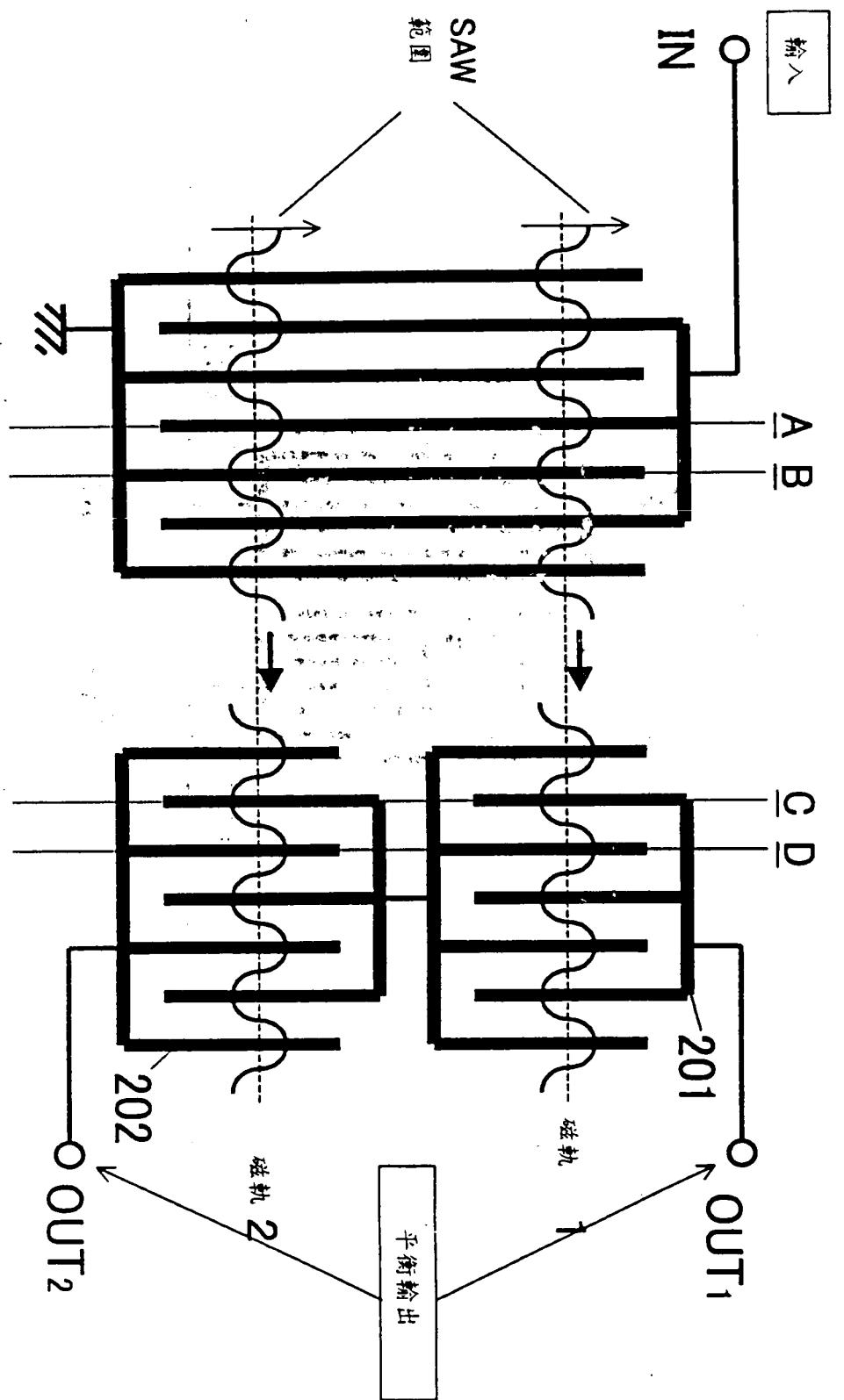
第3圖



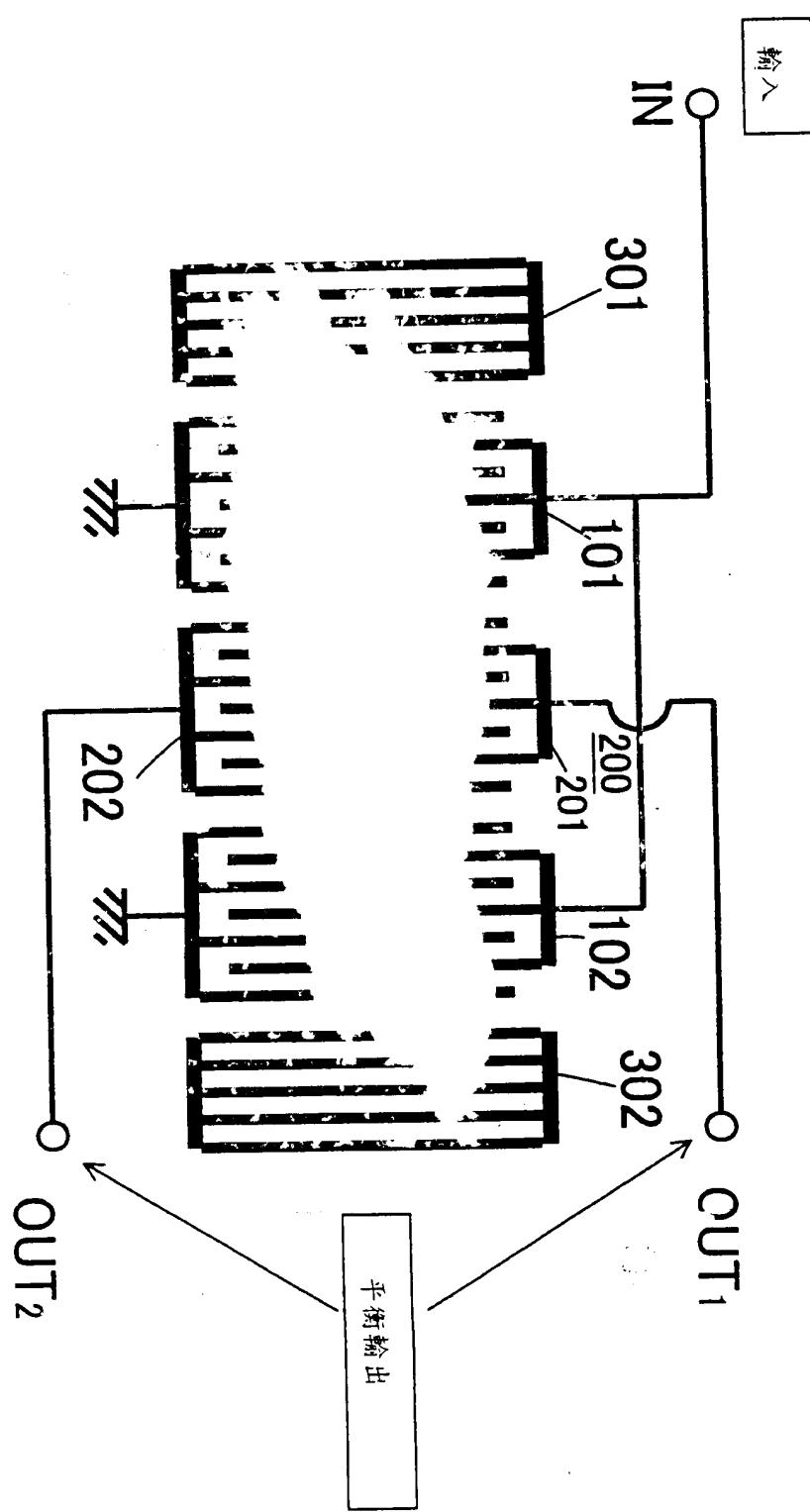
第4圖

100

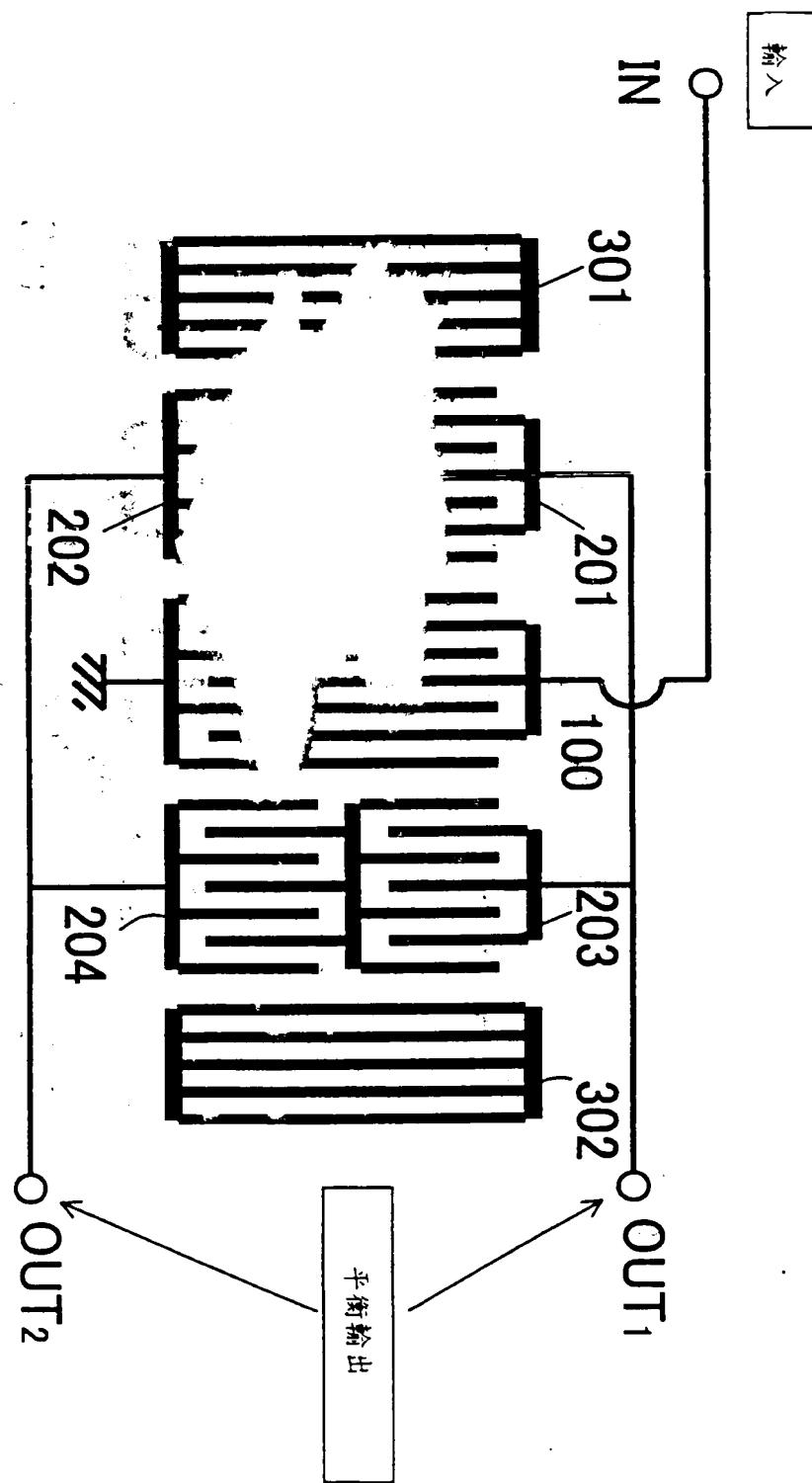
200



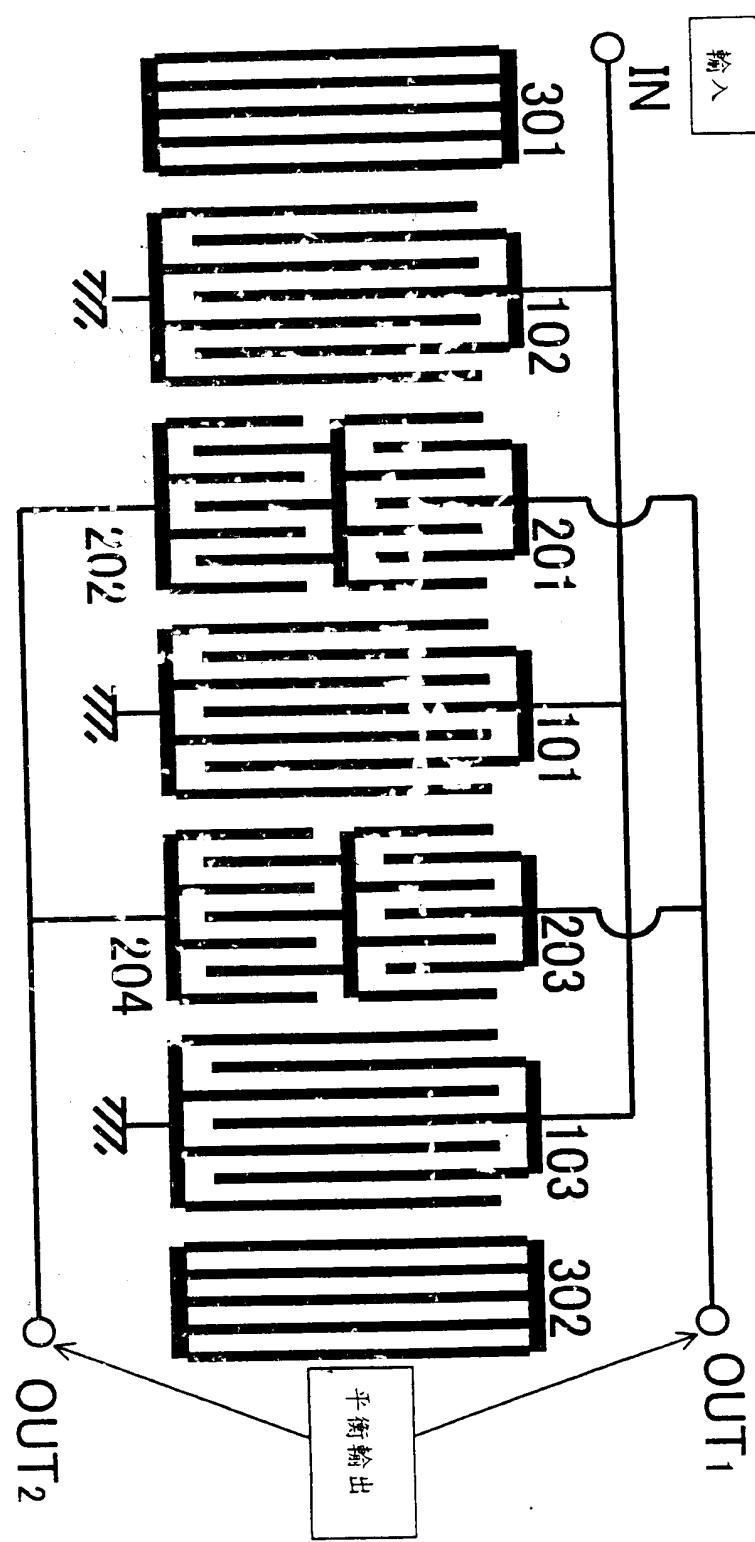
第 5 圖



第 6 圖

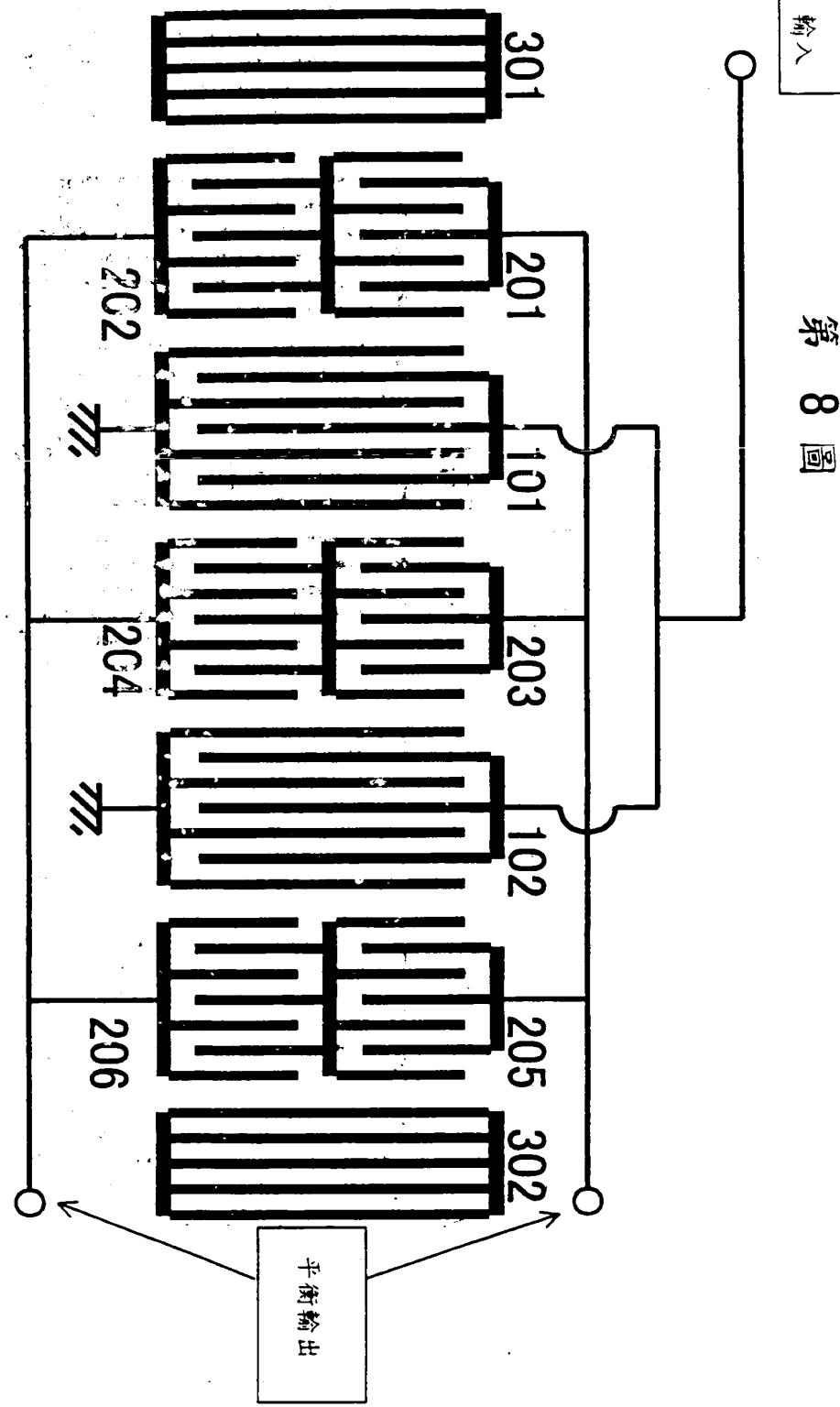


第 7 圖

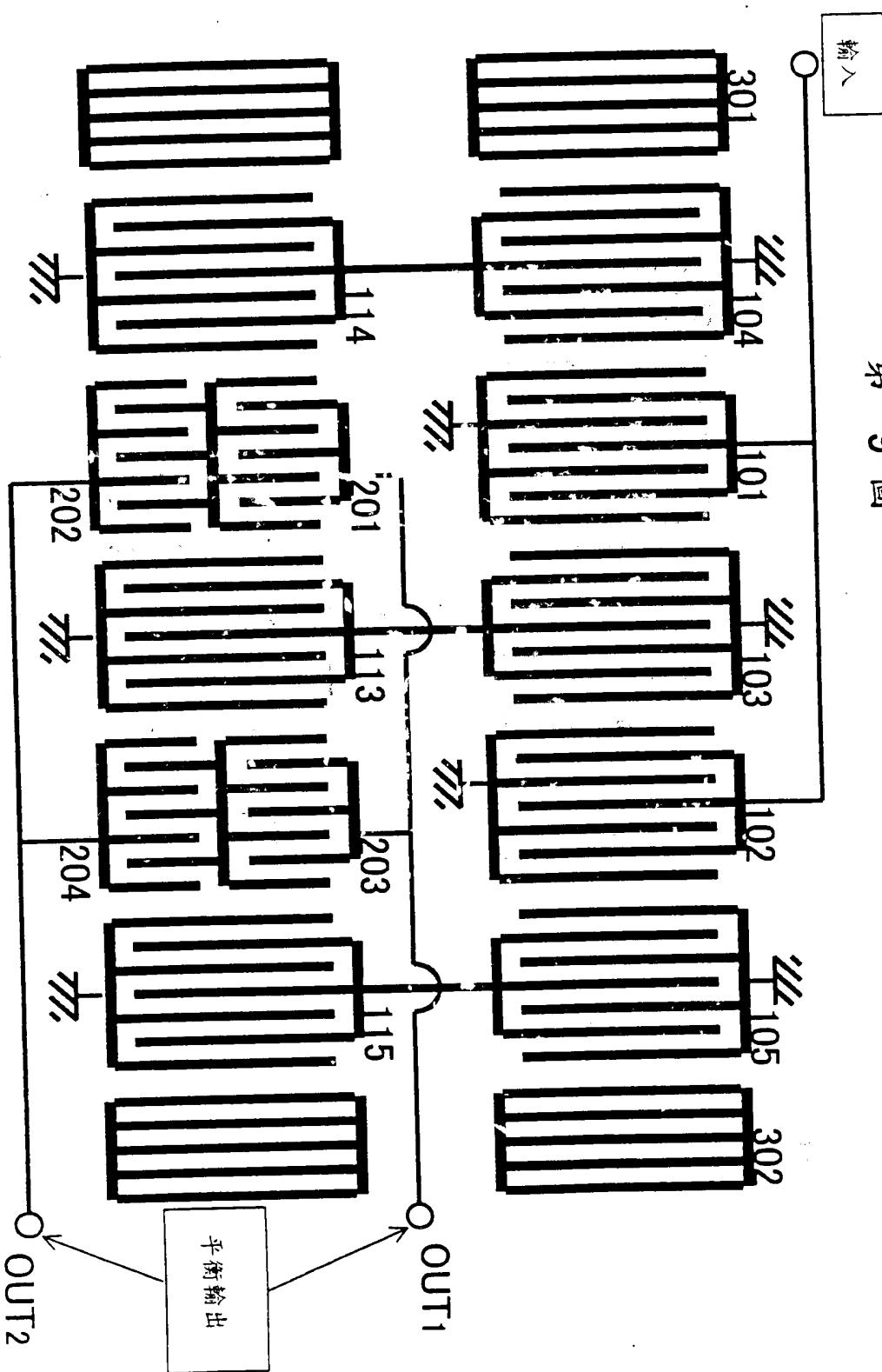


輸入

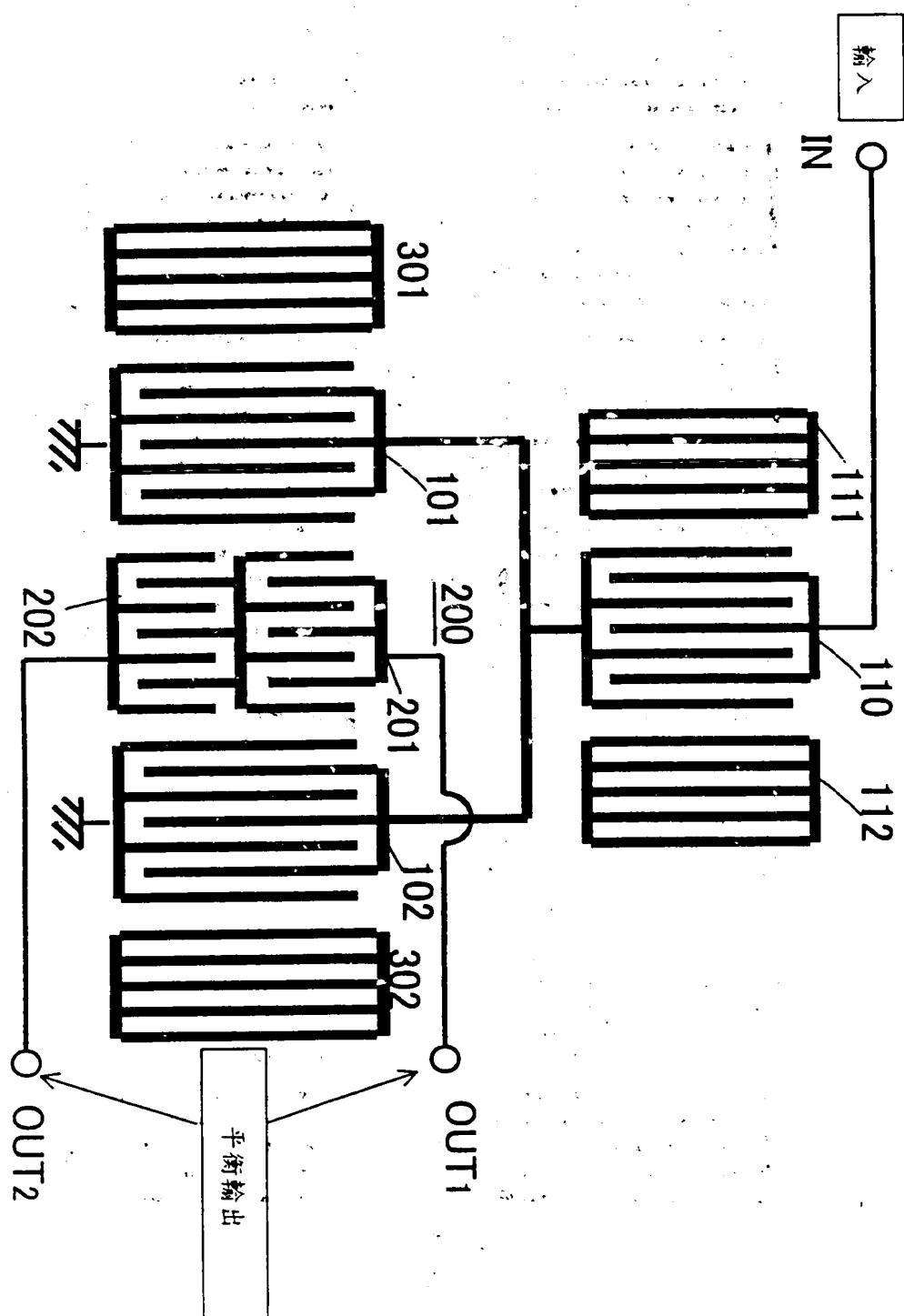
第 8 圖



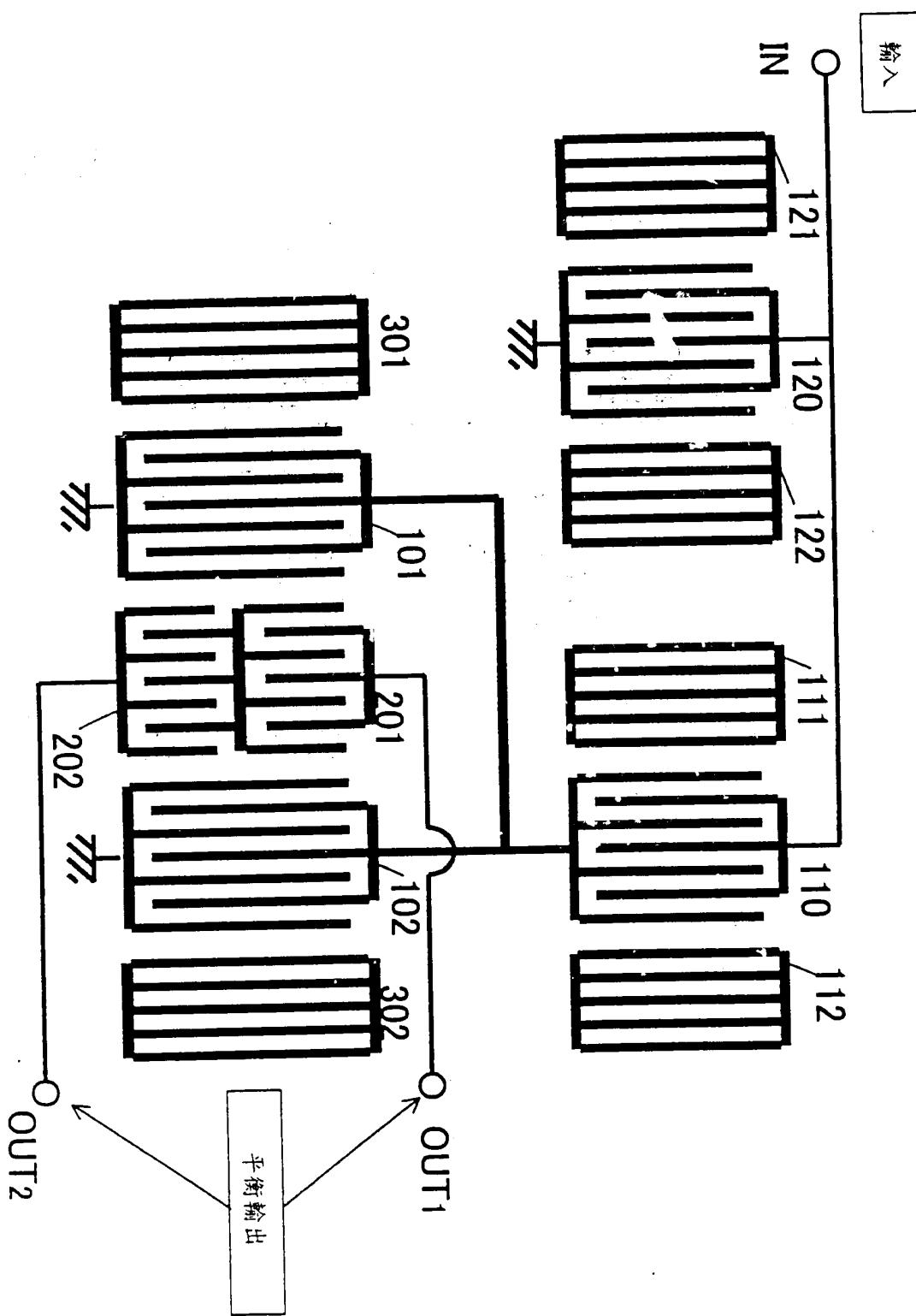
第 9 圖



第 10 圖



第 11 圖



第 12 圖

